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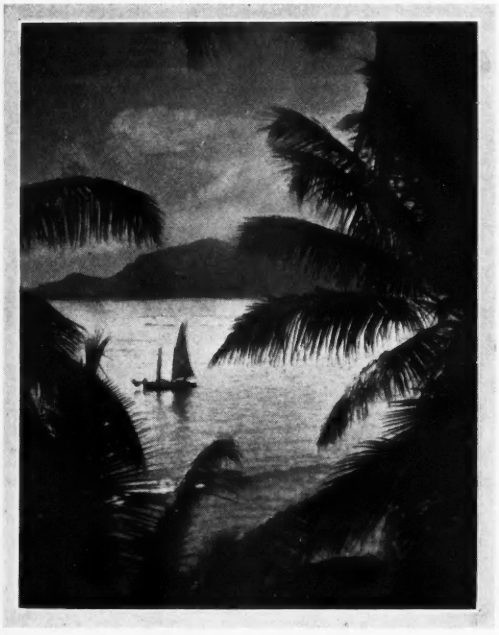

EVENING IN SEYCHELLES
An article on this little-known island in the Indian Ocean will appear next month

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Notes of the Month.

A DISCOVERY of far-reaching importance in the field of low temperature research is announced from Holland. The lowest temperature ever reached has been obtained by Professor W. J. de Haas and Professor H. A. Kramers in the famous Kamerlingh Onnes Laboratory at Rotterdam. It is eight-hundredths of a degree only above absolute zero and represents about 491 degrees Farenheit of frost. The results of low temperature work have important applications in electrical research, and in this branch of physics Dutch scientists have been distinguished. Kamerlingh Onnes, after whom the laboratory at Rotterdam is named, himself led the way in 1908 when he succeeded in liquifying helium.

* * * * *

The annual visit of inspection to the National Physical Laboratory, Teddington, provides an opportunity to view some of the most up-to-date apparatus for physical research in the world. The interest of visitors was centred this year on a remarkable impulse generator which was demonstrated for the first time. Million-volt sparks are generated, and the apparatus was used to show the effect of trees and buildings in attracting lightning charges. The sparks last for only a millionth of a second and are in effect miniature flashes of lightning. A block of wood is split from top to bottom when the current is applied, vividly demonstrating the way in which a tree may be effected by lightning. Other important branches of research conducted at Teddington during the past year are briefly reviewed in an article on another page.

* * * * *

Elsewhere in this issue plans are outlined for an expedition to Northern Spitzbergen under the auspices of the Oxford University Exploration Club. Cambridge University is also sending an expedition to the Arctic, to carry out a zoological survey in East Greenland. The party are to be given passages to Greenland by the French Polar Year Expedition, of which Dr. J. B. Charcot is the leader. Dr. Charcot's research ship, the *Pourquoi Pas?* is sailing to Scoresby Sound to relieve a party of scientists who have been engaged in meteorological observations in Rosenvinge Bay since last August. Running some forty miles northwards of Scoresby Sound is a fjord named Hurry Inlet. The Cambridge Expedition will attempt to sail up the inlet and to study the little-known country surrounding its head. The expedition is a small one and is not in itself part of the International Polar Year scheme; but it is breaking fresh ground and should have useful results.

* * * * *

Broadcasting has long been established as an important factor in education, and the B.B.C. broadcasts to schools are part of its regular service. It may be some time before television is adopted on the same scale, but the possibilities are obvious. At any rate a promising start was made on July 26th which saw the first "natural history lesson" to be broadcast by television. Animals, birds and reptiles from the London Zoo were seen and heard from the studio at Broadcasting House, thus following in the modest footsteps of the now celebrated performing seal which successfully enlivened one of the early programmes. The innovation is noteworthy not only because it was the first occasion in which animals not of the performing class have been televised, but also because the Zoological Society has been persuaded to allow some of its exhibits to leave the Gardens for the first time. We congratulate the producer of television programmes

on his enterprise and the Zoological Society on its foresight. Comparatively few people, perhaps, realize how much care and attention is being given at Broadcasting House to the television transmissions. The entertainment is of a very high standard indeed, especially in view of the limitations which television still to a large extent imposes on the scope of the programmes. Incidentally the latest "Televisor" will be on view at the National Radio Exhibition, which opens at Olympia on August 15th, and other interesting developments in this field are also expected.

* * * * *

A discovery recently announced in the *Lancet* is thought to have laid the foundations for important new research on the elusive influenza germ. Work on the disease has hitherto been hindered by the fact that it has been impossible to infect animals for study. Three workers at the farm laboratories of the National Institute for Medical Research have now discovered that influenza may be transmitted to ferrets. It has long been supposed that the germ is extremely minute, and the latest research has confirmed this fact by proving that it is able to pass through the pores of unglazed porcelain. Further study of infected ferrets is likely to have important results in discovering a protective vaccine; it will be remembered that this was the case with dog distemper when the discovery of a vaccine was made possible by the fact that ferrets could be infected with the disease.

* * * * *

The British Association meets this year at Leicester from September 6th to 13th, and as in previous years a special number of *Discovery* will be published to coincide with the meeting. The President, Sir Frederick Gowland Hopkins, will contribute to this number, and a feature of special interest will be Sir Oliver Lodge's reminiscences of the Leicester meeting in 1907. Among many notable addresses, Sir Oliver Lodge communicated a paper on "the Density of the Ether of Space," in which he abandoned Lord Kelvin's theory of an "elastic solid" and supported the treatment of the ether as a "fluid with a kinematic kind of elasticity." Sir Oliver mentions the view held in some quarters to-day that the ether itself is an unnecessary hypothesis, rendered obsolete by the Theory of Relativity, and he calls attention to the need for an ether "to weld the whole cosmos into a single whole." The September number will also contain an illustrated account by Sir Flinders Petrie of the last season's excavations in Palestine, an article by Mr. C. K. Ogden on the new Basic English, and other interesting features.

Some problems of British forestry were discussed by Professor R. S. Troup, F.R.S., in a recent lecture to the British Science Guild. Dr. Troup is Professor of Forestry in the University of Oxford and Director of the Imperial Forestry Institute. The lecturer disclosed the fact that the total world consumption of woods is 50 per cent greater than the total annual growth, an excess amounting in actual volume to over 17,000,000,000 cubic feet per annum. This, he said, pointed to a probable shortage of timber at no distant date. There were many reasons why Britain should maintain an adequate area of forest and work it scientifically in order to ensure a high state of productivity. It was desirable, for instance, as a measure of national security, for the better utilization of the land, for the growing of timber at present imported from foreign countries, and as a means of providing employment and encouraging small-holdings. In addition, as Professor Troup pointed out, an increased forest area would help to beautify the country and to develop a public "forest sense." The large afforestation scheme now in operation presents many difficult problems of a scientific and technical character. These are investigated by a special research branch of the Forestry Commission with the help of certain Universities, and in particular of the Imperial Forestry Institute, which is the chief centre of research on insect pests and fungal and other diseases.

* * * * *

The announcement that a five-gram unit of radium is to be lent by a Belgian medical organization for research in this country is a welcome development. The loan is an outcome of the report issued by the expert committee set up by the Radium Commission earlier in the year. The Committee then suggested that a unit of not less than five grams of radium element should be established, and the proposal was backed by many medical and scientific experts. The new research will be termed "beam" therapy and will be carried on at the London Radium Institute in Portland Place, under the direction of a representative governing body of which Sir Frederick Gowland Hopkins is chairman. It is sought to discover how far the present limited field of operation for a massive radium unit in the treatment of cancer may be extended by co-ordinated clinical, experimental and physical research. There was widespread regret when the Radium Commission decided to withdraw the four-gram "bomb" at Westminster Hospital, and the new facilities will be welcomed by all who are interested in the progress of knowledge regarding radium and its properties.

The Peace Conference and the Treaty.

By R. B. Mowat.

Professor of History in the University of Bristol.

The history of the war is now well known, and recent research has thrown much new light on the years immediately preceding it. But little is known about the Peace Conference which formed the basis of the post-war world. A considered view of the conference has now been presented by Mr. Harold Nicolson, whose book Professor Mowat discusses.

THE outstanding feature in historical research in the last fifteen years has been the amount of authentic documents which have been published, relating to recent history. The German Republican Government issued in 1919 and the following years the great collection of pre-war documents known as "Die Grosse Politik der Europäischen Kabinette," the French Government are publishing the "Documents Diplomatiques Français," the British Government "British Documents on the Origins of the War" and the Austrian Government "Österreich-Ungarns Aussenpolitik." The collections, when they are all complete, will amount to upwards of a hundred volumes of original and authentic documents, revealing the secrets and inmost policies of the Great Powers for the twenty years or more before the war.

Thus pre-war history is fairly thoroughly illuminated. The politics of the war itself, so far as there were any politics in that period of constraint and force, are also fairly well known. What is not well known, at any rate not from official sources, is the history of the Peace Conference and of the making of the Treaty of Versailles, which with the supplementary treaties made with Germany's allies, form together the great Statute of Europe. It may be said that the world since the war has been based upon the Peace Conference of Paris and the treaties of 1919-20.

Many Records.

There is no published official documentation of this momentous conference. Its records must be very numerous, and are distributed among many governments. The records of the French Government relating to the Peace Conference are, no doubt, rich; in particular, I believe that there is something in the nature of an official diary and register of the proceedings in many volumes, retained in the French Ministry of Foreign Affairs and not open to students or to public inspection. Certain participants in the conference have written important but unofficial works. Such works are "The Truth about the Treaty" by M. Tardieu, "What Really Happened at Paris" by Colonel House and Professor Charles Seymour, "The Intimate Papers of Colonel House" edited by Professor Seymour, and "President Wilson and the World Settlement" by Mr. Ray Stennard Baker. All these books appeared within the first five years after the conference. There is also the large and always useful co-operative work in five volumes, "The History of the Peace Conference," edited by Professor Temperley. Now, fourteen years after the conference, when the treaties of 1919-20 have been submitted to the tests of time and of human life and development, one of the younger participants has put forth a full and considered view of it.*

The Men at the Conference.

Mr. Harold Nicolson was at the time of the conference a member of the British Diplomatic Service of some ten years' standing. He was present in Paris as one of the twelve Foreign Office representatives included in the British Delegation. It is difficult to understand how the Foreign Office had so few officials at the conference. The figures which Mr. Nicolson gives are 257 for the whole Delegation, of whom the Foreign Office counted for twelve, with six secretaries; the War Office for twenty-eight; the Admiralty for twenty-two; the Air Department for thirteen; the Treasury and Board of Trade for twenty-six; and the Dominions for seventy-five. The numbers would appear wholly disproportionate to the task. There might have been a few more from the Foreign Office, for they could always be made useful; and there might have been less of the others. Even in war, the military men cannot be given much power, for if they are (as happened in Germany), there is sooner or later a bad miscarriage. Military men in war-time have only one duty, namely to win battles, and that is a sufficiently responsible task for anyone. All political direction should be in the hands of civilians. And if this is true of war, it is obviously emphatically true of making peace. Yet it cannot be said that the military men misled the Peace Conference. I believe that their views were what, on the whole, would be called moderate. The politicians, however, would not take the moderation of a military man very seriously; they would think that he was moderate because he lacked political knowledge. The Foreign Office men could not fail to be listened to with respect by the

* *Pacemakinge*, 1919. By HAROLD NICOLSON. (Constable, 21s.)

politicians who, in spite of their apparent self-confidence in public, are like all laymen, really submissive to the expert; and the Foreign Office men were all, by training, competent and well-informed in all the subjects necessary for peace-making. The outstanding difference between the Conference of Paris of 1919 and the Congress of Vienna of 1815 was that at Vienna the Foreign Offices of the Powers were in charge, at Paris the politicians. This, of course, is the same as saying that the Conference of Paris took place in a democratic Age, the Conference of Vienna in an aristocratic. Democracy has in many respects a good effect on diplomacy, but like everything else it requires a certain amount of guidance which can be supplied by the Foreign Office. There is no doubt that the Conference of Paris would have been much better managed than it was if the Foreign Offices of the Powers had been in control, and the Peace Treaties, which on the whole, are good treaties, would have been concluded without some obvious defects and eccentricities. Lord Carnock, an old Foreign Office man and diplomatist, whose life Mr. Nicolson wrote before the present work, said after the Conference was over that the diplomatists would not have made a peace of that kind. It would have been more moderate, more harmonious. At the same time I hasten to say again that the Peace Treaties were not bad treaties; their stipulations and arrangements were, in general, useful and good; but there were a large number of excesses in them, some due to politics, some to ignorance, some to the exhaustion of the politicians who were trying to work, after the strain of over four years of war, in a science to which they were unused, diplomacy.

Looking to the Future.

Mr. Nicolson is not writing to lament the past, but to put his experience at the disposal of future people. The conference had, he thinks, serious defects which can be avoided in future. For one thing he is of opinion that conferences would arrive at better results if the Premiers and Cabinet Ministers stayed at home, and if the business of making international agreements were left to the diplomatists, working of course on instructions from the Cabinet Ministers, and subject to ministerial and parliamentary approval. The reason which he advances for this view is that diplomacy is the art or science of negotiating documents. These documents, if they are to be of any use, must be precise and must represent workable conditions. Thy must, therefore, be negotiated with a certain degree of mental detachment and with intimate knowledge of the meaning and effect of diplomatic documents. Ministers and politicians are hampered by their democracies, and they are hampered by their mutual agreeableness and courtesy. They tend, in conversation with each other, to whittle away the difficulties between them, and so to end, not necessarily in a statesmanlike compromise, but in something rather vague, an imprecision, as Mr. Nicolson calls it. Now, professional diplomatists are polite enough, and indeed swathe themselves in many folds of agreeableness; but in all professional matters, when dealing with each other, they are perfectly tough and not in the least likely to land themselves and their people in imprecisions out of feelings of kindliness to each other.

The Element of Confusion.

The most serious fault in the technique of the Conference of Paris was that no prepared and thought out programme was adopted. A programme had in fact been prepared by the French, who have a genius for such things; and this was handed to President Wilson by M. Jusserand, the Ambassador at Washington, on November 29th, 1918. It was an admirable document, providing first for preliminary brief terms of peace, next for a Congress to make the final peace; lastly it contained a regular time-table according to which the Congress should function. It was a liberal document, too, in as much as it stipulated for the presence of representatives of the enemy-powers at the Congress, as well as representatives of the victors; and for the cancellation of all secret treaties made during the war. This helpful programme was ignored, for reasons that will probably never be fully explained. Mr. Nicolson's explanation is that the Jusserand Memorandum contained some disagreeable criticism of Mr. Wilson's Fourteen Points and of his proposals for a League of Nations.

For want of an accepted programme, the Conference, when it first met, on January 18th, 1919, was almost aimless and confused; and it continued in this condition for at any rate two months. Mr. Nicolson claims to have read most of the books about the Peace Conference, and says that they have one vital omission—the element of confusion. This accounts for the late period at which the Conference really settled down to its task of drafting definite terms of peace (not, apparently, until some time in March), and for the waste of expert knowledge which the small inner Council—the Big Four or Big Five—were unable to assimilate and to use. Mr. Balfour held a very useful morning council, at which he received reports from heads of sections and committees of the British Delegation and issued instructions to them;

but this was only in the later stages of the Conference, too late to influence the drafting of the treaty with Germany, though useful in the drafting of the Belgian treaty. The work of recommending and drafting was undertaken piece-meal by different bodies. There was, for instance, no committee for the frontiers of Hungary, though there was one for the Transylvanian frontier, and another for the Czechoslovak. "It was only too late," writes Mr. Nicolson, "that it was realized that these two entirely separate committees had between them imposed upon Hungary a loss of population and territory which, when combined, was very serious indeed."

The American and two of the British signatories to the Treaty of Versailles.

Not merely was the task of peace-making subject to very considerable confusion at the start, but for a long time, almost up to the last moment, says Mr. Nicolson, nobody knew whether it was going to be a Conference or a Congress. These two terms are not very precise, and there is no accepted definition of the exact difference between them. A peace congress, however, seems necessarily to imply that all parties to the war shall be represented at it as full negotiators. This was the case at the Congress of Westphalia, 1648, the Congress of Utrecht, 1713, the Congress of Vienna, 1815 (although the Allies intended to keep the ex-enemy Power, France, out of it), the Congress of Paris, 1856, the Congress of Berlin, 1878. It is now generally accepted that neutral states may also claim representation at a Congress, as happened at Paris, at the end of the Crimean War, and at Berlin at the end of the Russo-Turkish. "The Germans are to this day convinced that it was from the outset the deliberate intention of the Allies to exclude their representatives from any share in the peace discussions. In actual fact, this point, as other points of a similar nature, swirled as a small straw upon the gathering waters of the Conference." The original intention of the Allies was to agree among themselves upon the general terms (including disarmament and the main territorial cessions) of a Preliminary Peace, and to impose this upon the Germans; and then to negotiate with German plenipotentiaries a main or final Peace, which should include the economic terms, and possibly also the financial terms. This was the intention of the Allies for the first two or three months of the Conference (January—March, 1919). In March, however, progress towards a Preliminary Treaty had gone so far, and so many draft articles and recommendations had been produced by various committees and sections, that it was thought to be worth while to proceed with the making of the Final Treaty. This decision, most unfortunately, took over from the plan for a Preliminary Treaty the idea of imposition upon the Germans, without negotiation with them. Thus the Treaty of Versailles was absolutely and fatally marred.

In the management of the world's affairs there is nothing more important than the observation of the immutable principles of justice. A treaty is a contract. To impose terms without negotiation upon one of the contracting parties destroys the whole idea of contract, and is a travesty of justice. A treaty made after the complete military defeat of one of the contracting parties is bound to have an element of force and unwillingness about it, but if it is negotiated the life-giving element of contract is preserved. Without contract, the treaty is a measure of *force majeure*, and is in danger of depending for its maintenance upon *force majeure*. Thus it fails to provide a condition for the "moral disarmament" which every peace-treaty ought to produce, and without which no peace treaty is likely to be very stable.

There is a further matter in respect of which it may be contended that the principles of justice were not observed. The Germans surrendered on November 11th after making what is called the "pre-Armistice agreement." They submitted to the Armistice terms (which would prevent them from renewing hostilities if they should object to the final peace-terms) on the explicit understanding that the final peace terms should be made on the basis of President Wilson's Fourteen Points and his subsequent speeches—in all twenty-

three points. Mr. Nicolson contends that the Final Peace Treaty of Versailles, as imposed upon the Germans, failed in no less than nineteen points to correspond with President Wilson's twenty-three. To be quite accurate the failure was, I think, in respect of eighteen not nineteen (because the Freedom of the Seas was previously reserved in the pre-armistice negotiations by Mr. Lloyd George and M. Clemenceau); but this difference of one point does not alter the moral position. Mr. Nicolson's list of violations of the points is as follows: "Our covenants of Peace were not openly arrived at: seldom has such secrecy been maintained in any diplomatic gathering. The Freedom of the Seas was not secured. So far from Free Trade being established in Europe, a set of tariff-walls were erected higher and more numerous than any known before. National armaments were not reduced. The German Colonies were distributed among the victors in a manner which was neither free, nor open-minded, nor impartial. The wishes, to say nothing of the interests, of the populations were (as in the Saar, Shantung, and Syria) flagrantly disregarded. Russia was not welcomed into the Society of Nations, nor was she accorded unhampered freedom to develop her own institutions. The frontiers of Italy were not adjusted along the lines of nationality. The Turkish portions of the Ottoman Europe were not assured a secure sovereignty. The territories of Poland include many people who are indisputably not Polish. The League of Nations has not, in practice, been able to assure political independence to Great and Small Nations alike. Provinces and peoples were, in fact, treated as pawns and chattels in a game. The territorial settlements, in almost every case, were based on mere adjustments and compromises between the claims of rival states. Elements of discord and antagonism were, in fact, perpetuated. Even the old system of Secret Treaties was not entirely and universally destroyed."

The Tragedy of the Conference.

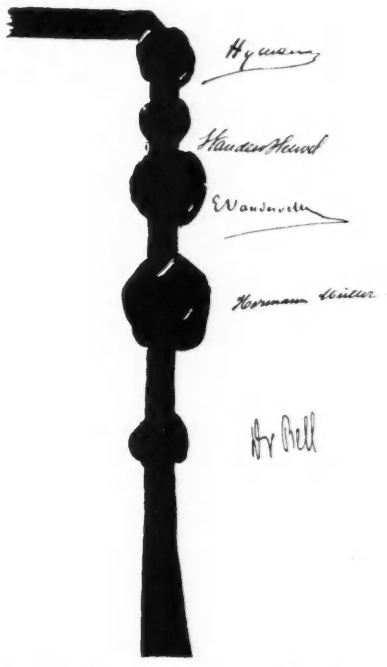
The tragedy of the peace conference was what has been called the collapse of President Wilson. The term collapse is not correct, for the paralytic seizure which broke him up physically did not occur until three months after the conclusion of the Treaty of Versailles. So far as there was a "collapse" on his part during the conference it was a failure of will-power, a failure of Mr. Wilson to keep a grip upon the Conference and to maintain his principles unswervingly in the face of all competing external influences. It is scarcely necessary to say that Mr. Wilson meant to secure the observance of his twenty-three points in the Peace Treaties. It is certainly true to say that the points, if not ignored in the Treaties, were at any rate interpreted very elastically according to the Allies' desires and prejudices, no discussion whatever being permitted to the Germans who, naturally, would have had a markedly different interpretation of their own. Mr. Wilson was one of the fairest-minded men in the world, and one of the most determined. It was his business at the Conference to keep the terms which were being drafted for the treaty, in conformity with his interpretation of the twenty-three points; his would be a thoroughly honest interpretation of his own points, and the Germans, who had made the pre-Armistice agreement primarily with him, could not have objected if his interpretation had been incorporated in the Treaty of Versailles.

Wilson's Fatal Step.

Various explanations have been given of Mr. Wilson's gradual consenting to the terms which, one by one, went to the making up of Treaties, in the main, reasonable, but in certain important details strikingly imperfect. The chief blame is put upon Mr. Wilson's decision to come to Paris in person. At the time of the Armistice and until he came to Europe, he had an absolutely unrivalled and unique prestige. His speeches and addresses had been literally a gospel to the disillusioned war-wracked peoples of Europe. Further, as the executive head of the United States, his material force was irrisistible. The United States was the only Great Power left in November, 1918 which had still any reserves, human or financial. All the other Powers, including Great Britain, were bankrupt of men and money. Mr. Wilson, with his unique prestige and with the inexhaustible resources of the United States could, if he had remained at Washington, have held the European states to the promises which they had given him. When, however, he came to Europe, he was under influences which, sometimes subtly, sometimes brutally, but always powerfully and almost inexorably, pressed him in the direction of his Allies' particular views.

At Paris he was really a tragic figure. If he had only stayed in the villa which had been lent to him in the Place des Etats Unis, and if he had left all the discussions in the Conference to his representatives—Mr. Lansing, Colonel House, Mr. Henry White—all might have been well. The fatal step was in his assumption of the position of plenipotentiary and daily negotiator. The double position of ultimate moral director of the Conference and of regular negotiator imposed a strain to which even a physically strong man, with no nerves or with nerves of steel, would have

been unequal. Mr. Wilson was constitutionally delicate and nervous. He had been diagnosed for *arterio-sclerosis* at the age of fifty (eight years before the Peace Conference), and had suffered under nervous breakdowns some seven or eight times. Although he never broke down during the Conference of Paris, he could not possibly cope with the task of controlling the decisions of the Allies, of assimilating the memoranda and other documentary material put before him by the splendid corps of United States experts, and of taking part regularly in the long, contentious, intricate discussions of the Council of Five or Council of Four, in the hot, close atmosphere of the little room on the Quai d'Orsay. Mr. Wilson's unfailing patience and carefulness only added to the impossibility of the task which he had imposed upon himself. He was sitting for long hours of almost daily conference with some of the most agile brains in Europe — men like Balfour and Lloyd George who saw the drift of a sentence before it was half-finished and who could scarcely bear to wait for the end ; and Clemenceau who, if not quite so quick in seeing points as Mr. Balfour, was at any rate just as keen to pass onwards, for he was not naturally a patient man, and his temper was sometimes rather short. Mr. Wilson could not always be asking at the conference-table for more explanations ; this would have delayed matters and it was also a little humiliating to a man who was not only the most powerful ruler in the world, but had also been head of a great university and a teacher of unrivalled authority. So, instead of asking for explanations, Mr. Wilson tended to let the business proceed to the next item with the previous item more or less settled.



The Belgian and German signatories to the Treaty.

The imperfections of the Treaty of Versailles were not due to wickedness or to a deliberate effort on the part of peace delegates to sabotage the fourteen or the twenty-three points. Contrary to what is usually believed, the various national delegates were not particularly greedy ; at least, Mr. Nicolson declares : " There was, whatever may be said to the contrary, comparatively little avidity in Paris." There was, however, a tremendous pressure from the democracies which the statesmen at the Conference represented.

The British press, even *The Times*, " at that date passing through a deeply humiliating period under the control of Lord Northcliffe," was extreme in its demands. There is an unfortunate " time-lag " in the opinions of Democracy. What its statesmen think to-day, Democracy will think to-morrow ; but this is too late. The chief statesmen at the Peace Conference—Wilson, Lloyd George, Balfour, Orlando, Clemenceau—wanted to make a moderate treaty of peace, but they had to try and make the kind of peace which their democracies would accept. They all managed to do so except President Wilson. His democracy (if the Senate is democratic) rejected the Peace Treaty, not because they were high-minded and thought the treaty too extreme, but because they objected to its only moderating and saving part, the Covenant of the League of Nations. The Peace Conference has been very unfairly judged because people have overlooked the fact that the statesmen there incorporated in the Treaties this remedial constitution, the Covenant of the League.

If the United States had ratified the peace treaties of which its President had been one of the chief makers, most of the subsequent troubles, which have arisen out of the treaties, would not have occurred. With the United States in the League, the French would have felt secure, and therefore reduction of armaments (one of the functions of the League) would have been achieved more willingly and quickly than has actually taken place. With the United States in the League, the mandates for former German colonies would have been better distributed and the terms of the mandates would have been made (as they ought to have been made) stricter. With the United States in the Reparations Commission, the liability of Germany would have been fixed at a more possible figure ; Germany would probably not have been declared in default at the end of 1922 ; and the invasion of the Ruhr would never have taken place.

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The New St. Lawrence Waterway of Canada.

When completed, the new St. Lawrence Waterway will be the most important shipping route in the world. This article has been prepared with the assistance of an engineer who has been intimately associated with the plans. It explains the engineering problems and discusses the economic significance of the scheme.

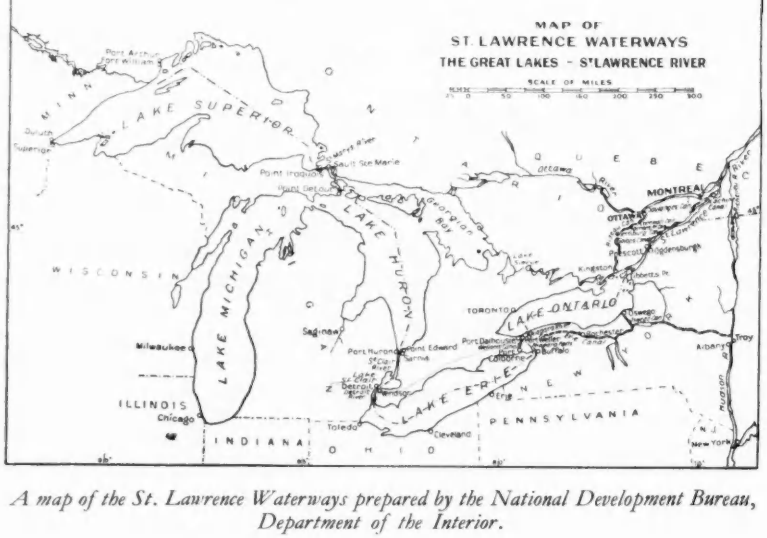
WHAT is the St. Lawrence Deep Waterway? What is the history of the present waterway and what is its importance to the continent? What is the estimated cost of the new deep waterway and what will its importance be? Why is there an acute agitation for its construction and completion? What is the waterway's relation, if any, to Imperial connexions and trade routes? These and a host of other similar questions naturally arise regarding this vast undertaking in Canada, and the following article will attempt brief replies to a few of the questions.

The phrase "The St. Lawrence Deep Waterway" connotes at present a proposal to construct from Montreal to the open water of Lake Superior a ship channel of twenty-seven feet in depth at regulated low water levels, and thereby eliminate the existing fourteen-feet canals, the present barrier to deep navigation between the ocean and the Great Lakes.

The project involves the improvement of the St. Lawrence river section both for navigation and for power, the absorption into the scheme of the New Welland Ship Canal (completed in 1932), the construction of compensating works to restore the levels of Lake Erie and of Lakes Huron and Michigan, the improvement of the interlake channels, and the construction of a new lock or the deepening of one of the present locks at Sault Ste. Marie. It is important to grasp that the proposal is not limited to an improvement of the river between Prescott and Montreal. It embraces, as a single unit, a great inland waterway 1,200 miles long, of which only about five per cent is in the form of canals, with an incidental power development of 5,100,000 installed horse-power, of which about 4,000,000 are located within and belong to Canada. This vast enterprise is to be completed as quickly as possible provided Canada and the United States, by their respective constitutional methods, ratify the treaty signed in July, 1932. Thus it is seen that the St. Lawrence Deep Waterway is primarily a navigational project, possessing, however, a tremendous future hydro-electric development, four-fifths of which is Canadian.

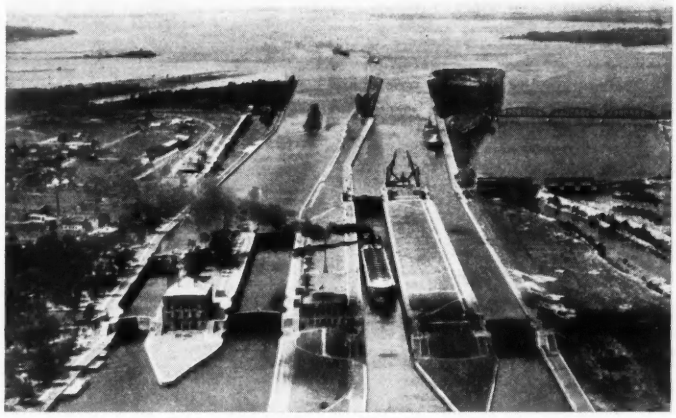
In order that the reader may have a clear grasp of the course of the Waterway, the accompanying map illustrates the Great Lakes—St. Lawrence region, and shows all the principal points, cities, rivers, Great Lakes, and canals on the whole system, stretching from Duluth and Fort William, its western termini, to Buffalo, Oswego, Albany and Montreal on the east.

Montreal is already well known as a great Atlantic seaport, indeed the greatest grain port in the North Atlantic range. Montreal now possesses a thirty-foot channel to the sea, which is being deepened to thirty-five feet at low water. Albany has just been created an Atlantic seaport with a channel having a minimum depth of twenty-seven feet to the open ocean, while Oswego is the natural Lake Ontario port for Albany shipments. Lying between Oswego and Albany is the only northern low level pass through the Appalachian



A map of the St. Lawrence Waterways prepared by the National Development Bureau, Department of the Interior.

mountains—a pass that has already affected profoundly the history of North America. Buffalo was until recently the United States eastern terminus of large "upper laker" navigation, Lake Erie being the eastern limit of the movement of big vessels drawing from nineteen to twenty-one feet of water.



An aerial view showing a large "upper laker" in one of the locks on its way downstream. (Royal Canadian Air Force photo.)

The existing canals necessary to make the waterway a continuous unit from Lake Superior to Montreal are: the Sault Ste. Marie (one mile in length and 24½ feet minimum depth), the New Welland Ship (25 miles and 25 feet), Galops (7½ miles and 14 feet), Morrisburg (3⅜ miles and 14 feet), Farran's Point (1¼ miles and 14 feet), Cornwall (11¼ miles and 14 feet), Soulanges (14 miles and 15 feet), and Lachine (9 miles and 14 feet).

The existing waterway provides a minimum depth of navigation of about nineteen to twenty feet between Lake Superior and the foot of Lake Ontario, the controlling channel depths being found in the Lake St. Clair region. From Lake Ontario eastward to Montreal the limiting depth in canals is fourteen feet of water. Thus it will be seen clearly that as far as immediate navigation is concerned, the most important part of the St. Lawrence Deep Waterway project still uncompleted is the river section, lying between Prescott and Montreal. The impressive Beauharnois power development on one particular portion of this river section (Soulanges section) is by far the most important existing power development on the St. Lawrence, and its works have been made to conform to the plans for the future deep water (27 feet) navigational requirements.

In a short article it is not possible to give any complete account of the history of the improvements to navigation along the St. Lawrence River—Great Lakes system. But a word or two may perhaps make clear the broad governing conditions. The history of the development of navigational facilities along the Great Lakes—St. Lawrence system might, perhaps, best be presented by quoting the dates of the first building and successive deepenings of the canals used to overcome the various natural obstacles to navigation. Detailed statistics would, however, prove tedious to the non-technical reader, but the following facts are of general interest. Little River St. Pierre on Lake Lachine was commenced in 1700, and never actually completed. But the commercial canals in the present location were last deepened to 14 feet in 1884. Sault Ste. Marie was opened in 1798 with a depth of about three feet; it was deepened for the fifth time in 1919 to 24½ feet. Welland Canals were opened in 1833 with a depth of eight feet, and were last deepened in 1932 to a depth of 25 feet. The work was commenced in 1913, but was interrupted by the war. 1842 saw the commencement of Cornwall Canal, then nine feet deep; it was deepened to 14 feet in 1904. Galops Canal was constructed in 1846 to a depth of nine feet and was also extended to 14 feet in 1904; while Farran's Point and Rapide Plat were both opened in 1847 with depths of nine feet and were deepened to 14 feet in 1901 and 1904 respectively.

For a period of more than two hundred years the residents in the localities affected by the various navigational obstructions have undertaken a constant series of channel and canal deepenings, each successive enlargement being brought about because each generation experienced economic benefit by the previous deepening. Consequently the deep waterway proposals cannot be looked upon as any sudden or capricious move. Such proposals are obviously the outcome of a long history of previous enlargements, and so far as a "long" view is concerned there is an air of inevitability about the proposed development to twenty-seven feet of water between Prescott and Montreal. And indeed the major part of the present

controversy deals not with the question as to whether these channels should be deepened, but rather whether the present time is opportune for the undertaking.

While in general the previous canal constructions have been in Canada, it must not be forgotten that the United States have participated vigorously in the general policy of navigational improvements. In addition to building two of the three deep water locks and canals at Sault Ste. Marie the United States have deepened most of the upper lake channels.

The importance of one portion of the present Waterway to the continent can be gauged by a few figures: In 1909 the total freight passing through all canals at Sault Ste. Marie, Michigan, and Sault Ste. Marie, Ontario, was 57,895,149 short tons. By 1929 the figure had risen to 92,622,017 short tons, but owing to the trade depression the figure for 1931 fell to 44,613,671 short tons.

These figures reveal what an extraordinary tonnage passed the Sault in 1929. In order to give a basis of comparison for such figures, it may be recalled that the freight carried through the Panama and Suez Canals in the year 1929 was about 30,600,000 tons and 30,000,000 tons respectively. Thus it is seen that the tonnage through the Sault Canals connecting Lake Superior and Huron (and Michigan) was half as much again as the combined tonnages of the Suez and Panama Canals, or, stated in a different way, the Sault Canal tonnage in 1929 was three times that of the Panama.

When it is remembered that the great majority of this freight has its point of origin on a railway and its point of destination on rail, and yet seeks water for a portion of its journey, one gets some inkling of the economic importance to the continent of the freight charges saved by such colossal movements of certain bulk commodities, in the main iron ore, grain, and coal. The traffic on the other portions of the Waterway, while not so spectacular as that found in the upper lakes, varies from six to eight millions of short tons of cargo—mainly grain. This traffic moves by water because the cost is cheaper than by rail—with consequent widespread benefit both to producer and consumer.

No Winter Navigation.

Perhaps the most serious criticism of the Waterway, either present or future, is the fact that the St. Lawrence Great Lakes system is closed during the winter. The open navigation is, roughly speaking, 7 to 7½ months. Space does not permit any adequate discussion of this natural and serious disability, but it must be remembered that all past benefits conferred by the Waterway have been brought about under the existing climatic limitations; they are not new to the deep waterway.

In discussing the cost of the St. Lawrence Deep Waterway as a whole, care must be taken to distinguish between the cost of the project as a navigational enterprise and the cost as a power enterprise. By long continued social development in North America the cost of providing navigational facilities has come to be looked upon as a direct charge upon either of the two Federal Governments. On the other hand power, whether developed under public or private auspices, is a social factor, the cost or liability of which is self-liquidating. Details of costs are not within the scope of this article, but it may be mentioned that the total navigational cost is estimated at approximately £91,000,000, and the total power cost at roughly £115,000,000. The distribution of the navigating cost between Canada and the United States will be effected on an approximately even basis. The power costs will be distributed in accordance with the nationality of the location of the power—approximately four-fifths to Canada and one-fifth to the United States.

A Bold Scheme.

It is difficult to set out briefly anything that conveys accurately the vast magnitude of the work. Perhaps a few facts, several of them related to the only completed portion of the new deep Waterway—the new Welland Ship Canal—will best serve to bring home to the general reader the greatness of the whole project. The boldness of the engineering of the new canal and its unique position among such structures in the whole world are striking. The new Welland Ship Canal is twenty-five miles long with only seven lift locks to transfer vessels through a vertical lift of 326 feet, the difference in the elevations of Lakes Erie and Ontario. The average lift per lock is 46½ feet, about eighteen feet higher than the lift locks of the Panama Canal—the only comparable structure.

The importance of the new deep Waterway to Canada and the United States must be appraised first on its navigational and secondly on its power aspect. The essence of the navigation is that between Fort William and Montreal there will be provided a clear channel of twenty-seven feet in depth with all fixed structures such as locks at an operating depth of thirty feet. Consequently a future deepening of the whole channel from twenty-seven to thirty feet could be accomplished at a comparatively small cost.

While many enthusiastic propagandists have envisaged a steady movement of large ocean liners into the Great Lakes once the channels are deepened,

it is dubious indeed whether such hopes will be realized. A more balanced and conservative judgment would indicate that the immediate future of the Deep Waterway will lie in making possible a continuous movement of the so-called large "upper-laker," with a certain amount of ocean tramp tonnage moving in and out. The large upper-lake vessels, of which S.S. *Le Moyne* is typical, carry from 12,000 to 16,000 tons of bulk cargo, principally grain and ore. With the Waterway in operation they could move from Fort William or Duluth direct to Montreal or other tidewater points, instead of being forced to find the eastern limit of their movement in Lake Ontario, with its obvious concomitants of extra cost of trans-shipment of cargoes into railway cars or canal vessels capable of carrying only about 2,500 tons of cargo. At present the majority of the large upper-lakers discharge their cargoes either at Georgian Bay or Lake Erie ports. Their entries to Lake Ontario waters, though now physically possible through the recently completed Welland Ship Canal, have not yet been as frequent as was expected, but each year will probably see a larger movement of the big vessels into Lake Ontario. The remaining barrier to deep navigation between Lake Ontario and all tidewater points is the fourteen-foot canals between Prescott and Montreal. Thus the completion of the deep waterway and the winning of some economic return on the capital already spent on certain portions involve the early deepening of the river section.

In addition to the economic benefit to the continent as a result of the continuous movement of the large lake vessels between the upper lakes and equivalent tidewater, it is highly probable that further benefits will result from the movement of a certain amount of ocean tramp tonnage through the new Deep Waterway. It must not be forgotten that 27 feet of water in the canals will accommodate about sixty-five per cent of all ocean shipping now afloat. When from this total one excludes the large "crack" New York liners (a class of traffic obviously unlikely to seek the waterway), the corresponding percentage of ocean tonnage is higher and even more impressive. The conclusion is inescapable—with 27 feet of water available, a considerable tonnage of ocean tramps will seek and use this essential route to the coast line of one of the most fertile and productive areas in the world. With 27-feet channels the Great Lakes

A view, looking south-west, of the first completed portion of the Beauharnois power station, showing the power and navigational canal just before the water was admitted. (*Beauharnois Power Corporation photo.*)

and St. Lawrence River become, as it were, great sea estuaries.

When finished, one can envisage the continent enjoying a marked reduction in the cost of moving bulk cargoes from the central continental regions to tidewater. While many extravagant claims have been made for the amount of these reductions in freight costs, it appears to more sober and thoughtful opinion that grain, perhaps a typical example, will benefit by probably three cents a bushel.

The St. Lawrence Deep Waterway will complete for some time to come the developments in navigation that have been proceeding for more than two hundred years. It will unite the open seas of the world with the five inland oceans known as the Great Lakes; it will rectify, in part at any rate, the disabilities of transport in the central region; it will offer in the St. Lawrence Valley abundant power coupled with unique facilities for transport, and when complete it will constitute the most important inland water route in the world.

Discoveries in the Near East.

By the month of July archaeological expeditions in the Near East are usually ready to make a report of the winter's work. Of preliminary reports which have already appeared two in particular are noteworthy. Dr. H. Frankfort describes his excavations on behalf of the Oriental Institute of Chicago at Tell Asmar and Khafaje. These two sites are on the east of the Tigris about fifty miles from Baghdad, and the joint expedition of the British Museum and the British School of Archaeology in Iraq now reports on its work at Tal Arpachiyah near Nineveh.

At Tell Asmar Dr. Frankfort has been engaged in a study of the chronological problem, with special reference to the dating of the tombs of Ur. This Mr. Woolley himself places at 3500 B.C., but other authorities are inclined to assign a later dating. Excavations were carried down through five cultural horizons, dating from the time of Hammurabi at the beginning of the second millennium B.C. to a period contemporary with the tombs of Ur.

A discovery of extreme importance was made in the strata contemporary with Sargon I of Agade (2750 B.C.), when the expedition brought to light dwelling-houses and a "palace." Similar buildings of this period have not previously been excavated in Mesopotamia. Tell Asmar also yielded some valuable evidence relating to religious cults in the form of carved stone reliefs from the temple of the Lord of Vegetation. Among these was a representation of the central mystery of the fertility cult—the marriage-bed of the god and goddess at the foot of which stands a priest. This find is unique, as although the Babylonian texts hint at the mystery, no other representation of it is known. Another relief is apparently the Mesopotamian prototype of the combat of Hercules and the seven-headed Hydra.

At Tal Arpachiyah, the most important site yet known for the earliest cultural history of Northern Iraq, no less than ten super-imposed villages belonging to a cattle-keeping agricultural people were exposed at the top of the mound. The examination of these villages provided some unexpected discoveries. Remarkable examples of the polychrome painted pottery were discovered in a large sacked and burnt house in the sixth village, which there is reason to believe was the home of the village vase-painter, and probably village head-man. Here were found amulets in the shape of the double axe familiar in Minoan Crete but nearly a thousand years earlier in date, thus confirming Sir Arthur Evans' suggestion that the double axe may have come to Crete from Western Asia. Immediately below in the seventh village an equally unexpected discovery was made in the form of circular buildings, identical in form with the bee-hive tombs of Crete and Mycenaean Greece. This is the first occasion on which buildings of this type have been found in Mesopotamia.

Professor Rostovtzeff's recent lecture on "Early Christian and Judaean Art in Mesopotamia" before the British Academy contained much unpublished material from his excavations at Dura. Here he has been working during the past six years on behalf of Yale University. Dura was originally founded on the Middle Euphrates as a Macedonian garrison-town about 280 B.C. Owing to its position on the edge of the desert it became an important gathering point for caravans, and consequently a great centre for a variety of religious cults and artistic activities. No less than ten temples have been found, mostly devoted to the Mother Goddess, though the temples of the Palmyrene gods appear to have been the most important. Both houses and temples were elaborately decorated with wall paintings which appear to have been in certain respects new departures in the art of the time. Most interesting to students are paintings from a Jewish synagogue and a Christian chapel belonging to the middle of the third century A.D., shortly before the city was destroyed by the Persians. These paintings depict scenes from the Old and New Testaments, among those from the latter being the first known representation of Christ healing the sick and of St. Peter.

A "New Model" for Science.

By E. M. Nicholson.

A letter in our correspondence columns announces the intention to form a British Trust for Ornithology so that the scattered resources of field observation may be pooled. The proposal is analysed by Mr. Nicholson, who treats the scheme as a model for all other branches of science which are confronted with similar problems.

None of the reasons for disorganization which are found in the everyday world applies with much force to science. Science has no deep roots in the past to invest its current forms with any particular dead weight of tradition or magic of accumulated prestige.

The Functions of Science.

Science does not, presumably, have to make concessions in its organization to the irrational prejudices which are supposed to cloud unscientific minds. Nor does the task of science call for a highly complicated or various structure to meet it. The raising and sound expenditure of funds, recruitment of suitable personnel, a systematic attack on chosen problems whose elements can be simplified at will by experimental technique, the unrestricted exchange of information among specialists, and the digestion of specialist results for the benefit of the lay world—these are the main and obvious functions common to all the sciences.

They evidently lend themselves well to objective treatment, because the functions to be performed are few, easily grasped, and constant over indefinite periods of time. No doubt the actual research on which scientists are engaged in 1950 or in 1970 will be different, but these mechanical necessities—adequate funds, adequate personnel, a common technique, a clearing-house and directive centre, and a means of putting discoveries into general circulation—are bound to remain, however their superficial character may alter.

These considerations would lead one to expect to find in the world of science patterns of efficient organization according to function. This expectation, unfortunately, would not be justified. It is, on the contrary, beginning to be conceded that science is far richer in examples of how organizations should not be run. Examination of almost any branch of science with the functions just mentioned in mind will show the most surprising shortcomings. We have to reckon with a structure of science which has grown up, like politics or business, just anyhow, and which now calls for complete reconstruction. To lay down lines for such a reconstruction is beyond the scope of this article. It may, all the same, be useful to take a single small branch of science—namely, that part of biology which is concerned with the living bird and is called field ornithology—and to outline the model of reconstruction which is now being attempted in this one concrete instance.

Field ornithology, like many other sciences, began taking shape under the Elizabethans and developed slowly during Stuart times. During the eighteenth century it made considerable headway and finally separated itself from other branches of natural history. First the identification of the bird, its nest and eggs, with all their variants and aberrations, was the focus of study. Then, towards the end of the nineteenth century, a school of amateur observers developed the intensive study of the individual bird, with the aid of field-glass and camera. During the past twenty years the orientation has changed again, and the emphasis is now on population, social habits, economic status, relations to the environment and so forth, although some of the older lines continue to be fruitfully worked.

This trend from systematy through pioneer field studies to large problems calling for organized teams of workers is by no means peculiar to ornithology. But the new field now entered is different in kind as well as in scale from the old. From its nature it calls for direction, collective resources, continuity of policy and other things which the individualist observer could do without.

Enterprising Observers.

In the British Isles the reaction to these needs has been spontaneous. First of all a few enterprising observers gathered what assistance they could and embarked on census work, food analysis and so forth, without creating any formal organization. Then regional or local groups arose and began undertaking more and more ambitious schemes of observation. At Oxford, in January, 1927, a scheme of bird census work combined with bird-marking and other co-operative studies was launched on a voluntary basis, and in 1930, with the aid of funds from private sources, from the Ministry of Agriculture and from the Empire Marketing Board, it developed into an institution known as the Oxford University Research in Economic Ornithology. This development involved some restriction of the original potentialities of the Oxford Bird Census of 1927, and the "economy crisis" of 1931 strengthened the arguments for

pooling the entire national resources of field ornithology so that at least a permanent nucleus would be available for future growth.

A round-table conference of some leading ornithologists met in February, 1932, and there was unanimous agreement in favour of a pooling of effort. This unanimity was the more surprising because ornithology has not escaped from serious divisions of opinion between groups of different outlook, which have repeatedly led to schism, even in very recent years. A committee was appointed to draw up a scheme for pooling the Oxford resources and all other common resources of field ornithology which might be available or become available in the future. The announcement almost immediately afterwards that the great Rothschild collection of birds from Tring Museum, which had long been looked upon as an integral part of the national ornithological resources, had been sold to America emphasized the precariousness of the existing situation, for collections have at least a money value to safeguard them against dispersal while MS. field notes and photographs, bird census material, and many other assets with which field ornithology is concerned are much more liable to destruction than the skins and egg shells with which the systematist has to deal.

Principles of the Scheme.

The outcome of this stage of the work was the draft constitution of a British Trust for Ornithology, which was accepted by a further meeting in November, 1932. The principles on which the scheme was drawn up may be worth discussing, as they have applications outside ornithology. In the first place the scheme provided for an authority to be set up by consent for field ornithology. Some authority was clearly needed. There was nothing to prevent any person who cared from launching, without consulting any competent specialist, a "national census" of some species or other. As these schemes involve broadcast appeals, much Press publicity and the co-operation of as many as a thousand or more observers, the dangers of leaving their initiation to untrained persons without any necessary qualification except assurance, and without any adequate consideration of the practicability of the scheme were evident. The whole development of large-scale census work on animal numbers ran the risk of being discredited. Economically also the building up of immense address lists and contacts by one observer after another with no facilities or experience for the task appeared to be unsound. If such work had to be done, it must be done efficiently and without becoming a nuisance to these who were threatened with a growing torrent of questionnaires on the numbers, habits and so forth of one bird or mammal after another, all emanating from different quarters with no contact between them.

Two Perils.

The opposite danger would be the establishment of a sort of bureaucracy which would try to stifle the healthy initiative of young or unknown observers. In order to steer between these two perils it was necessary to secure a representative basis for the appointment of the directive body, so that policy would in fact be amenable to the general wishes of those actively engaged in field observation on birds in the United Kingdom.

How to provide for this representation was the problem. The observers whose representation would be desirable were scattered in different areas, their small incomes often putting high subscriptions or long journeys to meetings out of the question. Moreover, there were already several active regional organizations, whose development would be prejudiced by the establishment of a national association claiming individual allegiance. Nor was there reason to suppose that an unlimited democracy would in fact represent the field worker successfully: more likely it would fall a prey to the irrelevant minority bickerings which have been the curse of British ornithology. The basis of organization to which these considerations pointed was not an orthodox one. In order to avoid wholesale poaching on the support of existing agencies, membership was to be limited in the first place to a couple of hundred. Of these members perhaps half would be individuals prominent in field ornithology, belonging in their own right, and the rest would be either corporate members or nominees of unincorporated organizations operating in the same field. So it would be possible for everyone who was doing work in field ornithology, whether individually or as a member of any sort of association or group, to be given a direct or indirect voice in the control of the British Trust for Ornithology, without its membership running to an unwieldy size or competing with other organizations, national or local.

The function of these two hundred members is to act as a Parliament for field ornithology. But field ornithology cannot manage with the crude model of Parliament which we tolerate at Westminster. The meetings must be reduced to a minimum, since attendance is inconvenient and difficult for many important members: therefore there must be an efficient executive with wide powers subject to control in principle rather than in detail. The executive

therefore had to be small and businesslike with no "paper" or "decorative" accretions: the Trust must, of course, have power to honour those who deserve well of it, but the way to do that is through the appointment of honorary members and patrons, and not through creation of fictitious offices or bodies that are never meant to meet.

The evident tendency of the small businesslike executive is to become an oligarchy with a vested interest in office, securing its re-election as a body at every annual meeting. In order to check such tendencies the constitution provides that after five consecutive years of office a member of the Council is not re-eligible until a year has elapsed, during which he has been replaced by someone else. A special arrangement is made in the case of the original Council to secure that not more than a third of the membership is automatically forced to retire within any two-year period.

A further danger to be guarded against is the subordination of scientific work to business demands. Responsible bodies cannot meet very frequently, and when they meet there is usually a good deal of miscellaneous business to be transacted. If the same body is in charge of a scientific programme and of administration the chances are that by the time the scientific part of the agenda comes up the meeting has lost its freshness, even if some of the members are not in a hurry to leave for other engagements. A lead and guidance in scientific research cannot be given in such circumstances, nor are the same minds necessarily competent to decide on the best method of administering funds and the best methods of using the energies of a team of volunteer observers for a bird census or an ecological survey. Recognizing this incompatibility it is necessary to devolve the direction of the scientific programme on a separate body, most of whose members are free from other ornithological duties, and can give ample time to team work in the field.

Personal Contact.

If the scientific committee were appointed purely as an instrument of the Council it might not enjoy the direct confidence and contact with all active observers which are essential to its success; if on the other hand it were elected it might become an incongruous group of people owing their position to other than scientific reasons, and even holding briefs for minority interests. An experiment is therefore attempted in blending nomination with democracy. The Council nominates members of the scientific committee, and they serve for three years instead of one, in order to avoid frequent reversals of policy. But the Council may not place on the scientific committee more than two of its own members, and at least two months before making nominations it must notify all members of the Trust, inviting suggestions for the vacancy and expressions of opinion on the programme of work and on scientific policy, special weight being given to the views of persons and bodies actively participating in field work under the Trust. The Council is further limited in its choice to persons currently engaged in field work on birds. It will be interesting to see whether this carefully conceived machinery succeeds better or worse than purely democratic or despotic methods in securing the best possible government for field ornithology.

A Perpetual Trustee.

Legally, the model of constitution favoured is incorporation under the Companies Act as a company not for profit limited by guarantee. From the point of view of current affairs other models might have served as well, but it is an essential object of the Trust to act as a perpetual Trustee for all actual or potential assets of British field ornithology. This implies that there must be something more enduring than a governing body which may itself be liable to liquidation or decay without any binding provision to prevent the diversion of its assets to purposes for which they were not intended, or their actual destruction. Incorporation on these lines, which is now being sought, gives every donor the fullest assurance it is humanly possible to give, because so long as the Trust lasts it is legally bound by its clearly framed Memorandum and Articles of Association, while even if it should come to an end, express provision makes a distribution, diversion or destruction of the assets by the Trust or its members illegal. At the same time, as a scientific and "charitable" organization the Trust should secure the most favourable treatment possible over rates and taxes.

In place, then, of a variety of unsatisfactory receivers the Trust sets up one universal permanent and efficient receiver, able to collect and hold assets and to utilize them in the enduring interest of field ornithology as a whole. The Trust will control an Institute of Ornithology which will house in one place libraries of books, MSS., field-notes, census maps and records, photographs and so forth. This Institute will form a co-operative centre which can be used equally by any individual observer for his own purposes and by the organized teams collaborating in researches directed or initiated by the Institute. In the rapid process of internationalization of ornithological work the Institute

will enable the United Kingdom to take its proper place.

Organizations and observers abroad will no longer have to depend on chance contacts in this country, but will have the benefit of an organization which is complete because its basis is functional. The Institute, that is to say, will not have members, but correspondents: contact will be informal, and as frequent as either side likes to make it, according to work in hand. Arising out of an Oxford undertaking the Institute will, at least in the first place, be located at Oxford and enjoy University privileges, but its scope will be national, without discrimination of any kind. An Oxford University Committee for Ornithology will co-ordinate its policy with that of the University in general and other biological centres at Oxford in particular.

Organizing Science.

If the model which has here been sketched is valid for field ornithology there is no perceptible reason why it should not prove equally valid for all other branches of science which are confronted with similar problems, subject of course to adjustments wherever they may be desirable. Here two questions arise: should the sciences be organized, and if so is there anything to be gained by trying to organize them as far as possible on the same model? The answer in the first case is obvious. The case for organizing science has been conceded at least since the foundation of the Royal Society in the seventeenth century; it is simply a question whether the organization is to continue on obsolete and wasteful lines, or is to be brought up to contemporary standards.

The second question is more difficult. Regimentation is a deadening influence, and the more healthy diversity of development occurs in science the more fertile science is likely to be. Yet the great task of re-fusion of science and the synthesis of its discoveries cannot be accomplished except on the basis of comparable standards and methods. To take merely field ornithology, problems constantly arise which overlap with animal and plant ecology, psychology, geological and topographical survey, entomology, agriculture, population study, aerodynamics, anatomy, parasitology and a number of other scientific compartments. In many of these the best man to consult may be in China or East Africa, or America, or Russia, instead of in Great Britain. Necessary contacts are therefore as precarious and uncertain as if they had to be arranged by lot. The only remedy for this is some fairly simple, fairly uniform world-wide organization of science on a regional and a functional basis.

But you cannot start world-wide organizations when even a compact homogeneous unit like the British Isles has still to be reduced to order. The first step must evidently be to build up efficient institutions of national or regional scope, out of whose collaboration an integrated world structure of science can be developed as fast as it is called for. Some sort of authority in each field to raise and spend funds, act as a permanent independent trustee, guide personnel, provide for the carrying on of current research in the least wasteful manner, secure co-ordination of results, and finally put findings into circulation as quickly and reliably and understandably as possible ought to be the first objective.

Once that objective has been attained exchange of information between different sciences and different parts of the world will become a far surer and simpler business than it now is. The duplication and uneconomic disposal of funds, delay and frustration in intercourse, waste of time in sitting on overlapping committees or tracing published data through the labyrinth of unco-ordinated publications, which are now part of the accepted routine of science, will no doubt appear to the future worker as effective and as congenial as the mediaeval transport system looks to us.

Fighting a New Tobacco Pest.

A NEW tobacco pest in the United Kingdom has inflicted losses of nearly £100,000 in twelve months. It is the Ephestia Elutella, or Cacao moth, brownish grey in colour and scarcely half an inch across when its wings are extended. The results of an inquiry by Mr. H. H. S. Bovingdon, of the Imperial College of Science, have just been published by the Empire Marketing Board. Experiments have proved that the moths have a preference for bright-leaf, kiln-cured tobacco, which helps to explain the severity of an outbreak in London in 1929, when there were in bond enormous stocks of Rhodesian bright tobacco.

The problem of preventing the tobacco from being attacked in transit seems insoluble if the bales are damaged, but bales wrapped in tarred brown paper, covered with a fine-meshed hessian (the moth cannot lay its eggs through a mesh 1/100 in. wide) have proved immune from attack when untorn. The reconditioning of tobacco by a modern machine will destroy all stages in the life of the moth. Control can also be exercised by vacuum fumigation with ethylene oxide, or by the application of low temperatures, but much remains to be done to complete the study of the life history and habits of Ephestia Elutella in tobacco warehouses.

Contemporary Design—II.

Problems in Interior Decoration.

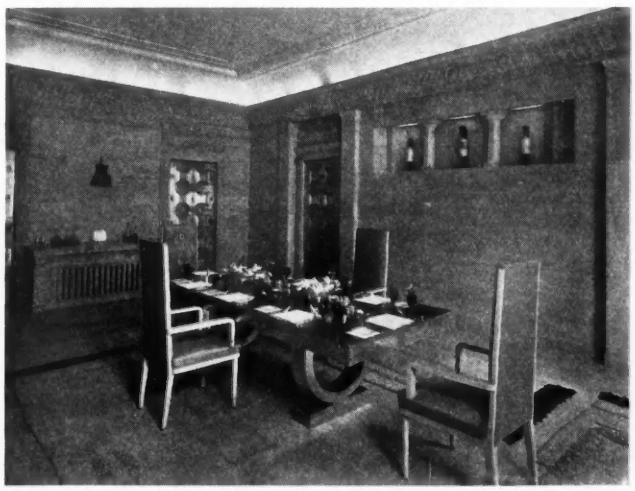
By Edward Halliday.

Continuing the series of articles on contemporary design, Mr. Halliday contrasts this month the two distinct problems with which the interior decorator is faced: creative work in new houses and the redecoration of old. Next month Mr. Alec Miller will contribute an article on modern tendencies in sculpture.

In the interior decoration of the home there are two separate and distinct problems to be faced by the decorator. On the one hand there is creative work in new houses, and on the other the redecorating of those which already exist, legacy of other times and different taste. It is the former which provides scope for the decorator who aims at a unity which may or may not be reflective of the spirit of our times, but, as far more men are engaged to-day on the refurnishing, the remodelling of Victorian and Edwardian rooms, compromising between the form and proportion of other times and the contemporary demand for simplicity, spaciousness and cleanliness, I propose to deal with the redecorators first. Moreover, they are of importance to those of us who are tired of the fussy, over-ornate houses in which limited means compel us to live and are desirous of simplifying them.

How far the prevalent desire for simplicity in the decoration of our homes is a reaction against the elaboration of the Victorian era or the result of the universal need for economy or the logical outcome of the hurried life outside the home, it is difficult to say; but the fact remains that applied decoration—that is, decoration stuck on to a room in the shape of mouldings, cornices, picture rails and what not, is conspicuous by its absence in the interior of the modern house as on the exterior. Everyone aims at simplicity — simple lines, simple proportions, simple shapes, and the crying need of the Victorians to add things to a room has now been replaced by an equally strong desire to take things away. "How good this room would be," one hears people say, "if only that moulding round the ceiling could be removed and that hideous fireplace in brown marble could be consigned to oblivion. And then this huge carpet—its simply an open invitation to microbes and takes one whole morning to 'Hoover,' but we can't do without it because the floor is so shocking—just horrid rough planks!"

The contemporary redecorator has a solution for all these and many other problems of the householder. Many new materials are at hand—glass, metal, cork and, above all, the plywoods and veneers of woods which, in their solid form could only be used by the very rich and then in but relatively small pieces, but now enable a room to be completely covered with rich figuring at a reasonably low cost. Nowadays a large choice of fine woods is available in plywood form—machutta, figured sycamore, maple burr, mocassar ebony, mottled ash, Nigerian cherry, mahogany, bird's-eye maple, to name but a few—and these form a considerable armoury of weapons with which to face the battle of reconstruction, for plywood covers a multitude of sins.

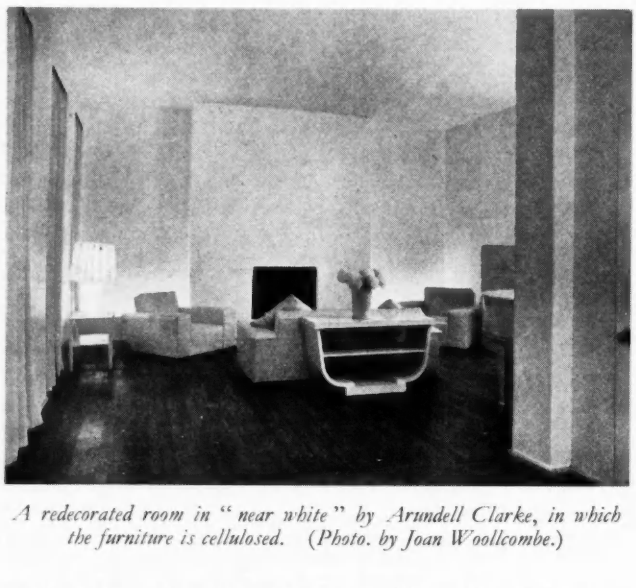


A dining-room with travertine walls and floor by D'Arcy Braddell. The table-top and doors are of pewter.

Mouldings are either ripped away or boxed-in with plywood which is then painted to appear as part of the fabric. The skirtings are removed, or (as in a flat by Arundell Clarke) enlarged to house a system of strip-lighting which flood-lights the walls and gives a diffused lighting to the room. The fireplace, if it cannot be removed and replaced by one of decent design—for some landlords cling to their potted-meat

monstrosities and Jacobean cast-ironwork as if they were rare examples of medieval craftsmanship—is boxed-in, again with plywood, and the result can be extremely pleasant either as setting for an electric radiator or as a more simple surround for the coal fire. If the spaces on either side of the chimney-breast are filled in either with bookshelves or other fitted furniture, the encroachment of the fireplace into the room is camouflaged and the room often assumes better proportions.

The boxed-in fireplace necessarily provides a wide ledge along its top which can be covered with glass or stainless metal or porcelain and accommodate those oddments—pipes, books, flowers, etc.—which make a room look "lived in." On the whole, however, there is a tendency to do away with mantelpieces of any kind. An electric radiator can be set into the wall without the need for any chimney-breast and ample accommodation is, as a rule, provided for oddments on the fitted shelves and in the cupboards of the modern living room. As electric stoves require no vent or flue, it is even possible to detach them from the walls altogether. The portable radiator is well known, but at the recent exhibition of Industrial Art at Dorland Hall, London, a living room was shown in which the electric stove took the form of a column some three or four feet from the wall and reaching from floor to ceiling; the heat elements were housed in a cylindrical steel casing at the foot and the rest of the column was of glass illuminated by strip-lights, the whole being reminiscent of the stoves of Sweden and Russia in that the "focus" or "hearth-scene" is out in the room instead of being in one wall.



A redecorated room in "near white" by Arundell Clarke, in which the furniture is cellulosed. (Photo. by Joan Woollcombe.)

With adequate central-heating, fireplaces and radiators should, of course, be superfluous—except perhaps for bedrooms, which are kept at a lower temperature than the rest of the house—but some sort of "focus" is still necessary in our living rooms. It is difficult to imagine ourselves on cold winter evenings drawing our chairs up to the hot-water pipes, and some find the still efficiency of an electric element a poor substitute for the cheer of a coal fire. The compromise in the shape of those quaint contraptions, those "olde yule-logge electric radiators," with imitation coal or wood and flickering lights to counterfeit the effect of flames, is, however, to be deplored. The play-acting in this case seriously impairs the efficiency of the elements which lurk, shamefaced, behind the sham. Mr. Wells Coates, the distinguished architect, argues that in the modern living room the radio set must to-day compete with the source of heat as a "focus," and in the flats in Hampstead which he has designed he has contrived a neat, compact shape, projecting into the room, which houses both radio set and radiator. The front consists of metal louvres, the lower ones covering the heat elements and the upper the loud-speaker.

The coal fire, however, still lingers in spite of its dirt and inefficiency, but to-day it is framed quite simply and is not a mere item, a relatively small hole in the elaborate setting of mahogany or marble and bevelled mirrors and innumerable shelves and cornices, which was the Victorian fireplace and overmantel.

As I have mentioned in my earlier article, the many activities of the modern living room demand a simple yet flexible arrangement of its fittings. At short notice space may be wanted for dancing or other entertainment, and the small house or flat of to-day will not allow of furniture and carpets being moved from one room to another. Thus, large carpets, like large pieces of furniture, expensive to buy and difficult to keep clean, are being banished from the living room and more attention paid to the actual flooring. Here again the redecorator's work in providing a beautiful surface is simplified by the new materials at his command. An old uneven floor may be covered completely with thin parquet or narrow oak planks, with cork squares or large sheets of plywood which, if carefully joined and highly polished, give a

glass-like surface. A rug or two, of good design, will add vigour and colour to the room, and in this connexion the names of Pepler, Dorn, McKnight Kauffer and Francis Bacon are well known. Glass or porcelain is used for wall coverings especially in entrance halls, bathrooms and kitchens, and glass tiles make a really beautiful floor where hardness and durability are desired.

Old doors may be brought into harmony with the rest of the room by covering them with a single sheet of plywood and substituting for the small handles the metal or glass door furniture of the modern designer, but windows present a more difficult problem, and short of replacing the often clumsy and light-excluding woodwork by steel, very little can be done. Difficult too is the artificial lighting of the reconstructed interior, for the rooms in some of the older houses are so high that, should the dangling flexes and chains be abolished and close-fitting lights take their place, an extremely high candle-powered lamp would be necessary to give adequate light. Much can be done by strip-lighting around a cornice or in the pelmet of the window curtains, but most decorators rely on wall lights for general lighting and occasional either standard or reading lamps for concentration. In some cases, where rooms overlook a not too prepossessing back yard, or the chimney pots and roofs of immediate neighbours, frosted glass is inserted in the window frames and lamps fixed in troughs round the outside. As this makes the room dark during the daytime, a better idea is to place the lights inside the window, though concealed from the room, and at night draw across the whole thing a screen of silk. This has been done with great effect by Mr. Wells Coates in the redecoration of a house in Kensington.

Many modern decorators achieve an austere beauty by sheer simplicity.
(Photo by courtesy of "The Cabinet Maker.")

And now a word as to colour. Just as the dust-trap mouldings have gone from the ceilings, doors and skirting-boards, the fireplaces and window frames, elaborate carving from the furniture and door handles, so has the general colour scheme of rooms become simple to the point of austerity. The need for pattern, one of the most primitive of human needs, is now satisfied by light and shade and the textures of materials. The door, plain in form as it is, can be covered with figured veneer or cellulosed any colour, the door furniture a glittering stainless steel either plain or tinted. The walls, painted or distempered or covered with glass or plywood, are free from irritating pattern, but may be of agreeable colour. It is the fabrics, the rugs, curtains and chair coverings which provide the exciting and colourful pattern—they are the accents in the decoration of a room which forms their background.

This idea of background, the making of a room into a setting for particular items, has of late been carried to its logical conclusion. I refer to the fashion known as "off white" or "near white" decoration which would make everything — furniture, curtains, walls — a background for the human occupant of the room. It is the apotheosis of individualism. The human being is the most important furnishing in the room and nothing must distract his attention from himself or his guests. Mr. Arundell Clarke, one of the most brilliant exponents of this form of *décor*, has produced some superb interiors, playing on a limited range of white notes. His interiors are the antithesis of the Victorian drawing-room; there is virtually nothing in the nature of embellishment or "applied" decoration, and he achieves a sort of austere beauty by sheer simplicity.

Some people, however, prefer their background to reflect rather than silhouette themselves. They like to have things about them which amuse or stimulate and, because they reflect their taste, are a part of themselves. The more subtle interior decoration which is evolved from plain surfaces has, quite inevitably, resulted in the abolition, except perhaps for a single example at a focal point, of pictures as decoration on walls, though it has produced something

like a revival of mural decoration. Wall paintings do not destroy the surface or the proportion of a wall, and many rooms are now enriched with delightful paintings of this kind, whose subject-matter, or motifs, reflect the taste and depict the activities of the members of the household. Simple surroundings make some people uncomfortable. They liken modern austerity to operating theatres and dentists' parlours. For them there are decorators who will cover the walls with plaster pilasters and rococo carving (I recently saw a modern electric wall light in the form of a hand holding a sphere); there will always be lovers of baroque.

Creating New Things.

So much, or rather so little, for I have been able only to touch upon a few of the problems which face the redecorator, for the rejuvenation of old interiors. I would like now to consider, quite briefly, the aspect of interior decoration from the point of view of the architect, the designer and creator of things new.

The work of the architect is to provide accommodation for his client. We have seen, moreover, that the modern architect solves his problems in a purely functional way and builds in as much of the furniture as possible, thus making of the whole house a unit which will fit the needs of its occupants. He is like a tailor building a suit of clothes to fit one particular man.

When he has done so much his job is really finished, but just as the tailor allows the choice of material to be made by his client, so will the architect allow the personal taste of the man who is to live in his house to suggest the particular wood of which the fitments are to be made, the colour the walls and doors are to be painted, the design of the fabrics, and so on. The designers of large blocks of flats stop after they have provided functional dwellings and the tenants can enter and proceed "to spill their bright, incalculable souls" as they will.

Unlike the redecorator, the architect looks upon the decoration of the rooms of his dwelling as the final completion of his art and if he can, he will control its design down to the smallest detail. Only thus can the building become a work of art. He may delegate the designing of the furnishing to others but his, the mother art, remains predominant and must influence their ideas if not actually dictate them. His work as decorator therefore differs from that of the reconstructor in fundamentals. There are no amusing problems such as ugly fireplaces, fussy cornices or inadequate lighting to be tackled; no camouflaging of bad proportion or compromising with existing furniture. His work is completion not deletion, and he has freedom to create new forms and evolve new ideas impossible to the redecorator.

The "Week-end House," designed by Mr. Chermayeff and exhibited at the Dorland Hall Exhibition, showed how decorative are wooden partition walls, and that a house with large windows and fitted or unit furniture leaves little to be desired in the way of added embellishment. The effect of a piece of sculpture here, a small painting there, a rug or two on the floor and the texture of glass and furniture and dark plywood panelling, is wholly satisfying. The "Plan" chairs in this house can be obtained in other sizes and colours which give ample variety and fulfil every furnishing demand, and moreover preserve a direct relationship between the wood, the fabrics and other components of the modern house and its equipment, in colour and texture.

Another example of the work of the architect-decorator is the "Minimum Flat" by Mr. Wells Coates in the same exhibition. It was an exact replica of one in the block at Hampstead mentioned above. The living room, lit by a large window with top-hung ventilation and sliding sections below, is equipped with a mahogany dining table arranged to slide, on a groove in the wall, into one corner. There is a divan-bed opposite the window and along one wall two plywood book units and the projecting fitting containing the electric fire and electric radio comprising the "hearth-scene." The wall facing is of mahogany plywood, the door to the dressing and bathrooms and the kitchenette, sliding in grooves against it, thus saving valuable space. The walls above the unit furniture are distempered cream; the flooring is Cellulin, a pink hard composition. This flat is designed to accommodate one person as efficiently and economically as possible. There is nothing expensive or luxurious about it, and yet economy of means has produced quite pleasing decoration.

"Inevitable" Furnishings.

One feels that the articles in the room—the Paul Nash reproduction on the wall, the rugs, the white easy chair, the light fittings—whether attached to the fabric or not, are in fact part of it; each piece is as inevitable to that particular living room as the room itself is to the requirements of one occupant and to the planning of the building as a whole. It is a perfect justification of the slogan of the contemporary designer—"Fitness for purpose and pleasantness in use."

SOME MODERN INTERIORS.
Some striking examples of modern interior decoration on view at the Dorland Hall Exhibition. (Photos by courtesy of "The Cabinet Maker.")

The National Physical Laboratory: A Year's Research.

The past year's research at the National Physical Laboratory, Teddington, ranges from investigations into the sea-worthiness of ships to a study of the crystal structure of decay in teeth. Items of general interest are here reviewed.

A FEW years ago the application of measurement to colour was of interest only to a few experts in the colour industries: nowadays the layman profits from it in numerous ways. He can now buy standardized paints; he can travel by rail with the increased security afforded by the fact that the driver is guided by signals whose colours are specified within standard limits; he is rapidly becoming accustomed to having his movements by road controlled by light signals whose colours have to be carefully standardized to minimize the possibility of confusion; and in many less direct but equally important ways he benefits from the improvements which are being effected in the quality and adaptability of the products of the colour industries by the increasing use of scientific methods of measurement in their research laboratories.

Traffic Signals.

The basis of all such work in this country is the system of colour standardization developed and maintained at the National Physical Laboratory, Teddington. Here the colour measuring instruments used in other laboratories can be standardized, and the actual work of fixing, by numerical specification, public standards such as those relating to rail and road traffic signals, has been mainly carried out. It is of interest to note that the system of colorimetry developed at the Laboratory has been adopted for international use with only slight modifications.

Investigations have been in progress during the last year or two on the propagation of ultra-short waves (wave lengths from one to ten metres) along the ground. Experiments have been carried out to determine the nature of the reflection of such short electric waves from the ground, and thus to obtain a knowledge of the electrical properties of the ground itself. With the aid of apparatus developed at the Laboratory, measurements have been made of the falling-off in field strength at the receiver as the distance from the transmitter is increased. By comparing the experimental results obtained in this manner with theoretical calculations, values of the electrical conductivity of the earth have been obtained. Research work is also in progress on the production of still shorter waves of wave-lengths less than one metre.

The problems encountered in the transmission of electric waves along the earth's surface have promoted fresh interest of recent years as a result of their connexion with broadcasting on the one hand, and the application of short waves to practical communication on the other. At moderate distances of fifty or one hundred miles, the waves from a wireless broadcasting station travel along the earth's surface, and some of their energy is lost in setting up electric currents which have to overcome the resistance of the earth. If the earth is a good conductor, this energy loss is reduced to a minimum, and thus the field strength of the waves is maintained to considerable distances and good reception results. If the ground is poorly conducting, the waves lose their energy rapidly and poor or indifferent reception is obtained. It is because the sea is a good conductor that signals received across the sea are much stronger than those received under similar conditions over land. With the object of increasing the available knowledge on this subject, an investigation is in progress in which the electrical constants of samples of soil are measured in the Laboratory over a wide range of frequencies. Samples of soil taken from a number of sites in different parts of the country have been examined in this manner, and the results obtained show that considerable variation in the earth's conductivity prevails in different places. The experiments have also shown that while dry soil is a comparatively poor conductor, the conductivity increases more than 1,000 times when the soil contains the amount of moisture met with in this country under normal weather conditions. A knowledge of the properties of the soil obtained in this manner is important in connexion with the location of wireless transmitting stations, and also in connexion with the study of the mode of travel of wireless waves over the earth's surface.

Machines that Will Not Wear Out.

Abrasion of metals may be defined as the unintentional removal of the surface of a metal in service due to friction. It is this action which is responsible for the comparatively short life of machine parts, and if abrasion could be eliminated, it would be possible to make machines which would never wear out. In order to reduce friction, and consequent wear, lubrication is resorted to, and it is known that, were *perfect* lubrication obtainable no wear would take place. Such wear as occurs is due to the partial failure of lubrication. Thus the problem of wear falls into two parts; firstly, that of lubrication and secondly, that

of the wear of unlubricated surfaces. This second aspect also has direct applications in practice, for instance, in the wear of railway tyres and rails.

The work at the National Physical Laboratory has dealt particularly with the second part of the problem, although a comprehensive programme of research on lubrication is also in progress. A machine has been constructed in which rollers of the metal under test are pressed together with a known pressure and rotated either in the same or in opposite directions, so that pure rolling or pure slipping can be obtained. Also, by means of a gear, a combination of the two can be applied. After running the machine for some time, the rollers are removed and weighed, and the amount of wear thus obtained. In this way the effects of different factors in the problem are being investigated.

Improvements in Aircraft Research.

The use of wind tunnels to provide data for the design of aircraft was established in the earliest day of flying, and various aspects of this work have been dealt with from time to time in *Discovery*. The question arises as to how accurately the results on small models can be applied to full-sized machines. The comparison of wind tunnel results with the measured performance of machines in flight has indicated that in many cases the correspondence between model and full scale is very good indeed, but that there are certain important exceptions. Full-scale experiments in flight are of necessity difficult and take a long time; moreover, one can only test the whole aircraft and not its separate parts. It would therefore be valuable if tests on models in the laboratory could be made under conditions which would ensure that the results were *exactly* applicable in all cases to the full-scale counterpart.

This end is achieved by the compressed air tunnel, which consists of a wind tunnel enclosed in a steel shell of great strength so that tests can be made in compressed air instead of in air at normal atmospheric pressure. It can be shown theoretically that the result of using air at say twenty atmospheres pressure is precisely the same as that of using a model twenty times as large, or increasing the wind speed twenty times. To be more precise, the use of compressed air in the wind tunnel is equivalent to a corresponding increase in the product of the model size and the wind speed. Thus, in the tunnel now under construction, a wind speed of about ninety feet per second will be attained at twenty-five atmospheres pressure, and this wind, blowing upon a model of one-tenth scale, will simulate precisely the conditions of the full-scale machine flying at about 150 miles per hour.

The great utility of the compressed air tunnel is that it enables a test to be made under conditions corresponding with actual flight. A case in point is the use of various types of flap to produce high "lift" in order to reduce landing speed. Devices of this kind have been widely discussed lately in the technical Press and it is known that in ordinary wind tunnel tests they produce surprisingly large increases of lift. It is also known that certain thick wings without flaps produce a much lower maximum lift on full scale than they do in a wind tunnel. Do the flaps behave in the same way? The question can be quickly answered by the compressed air tunnel and typical models of wings with flaps are being prepared in order to test the point. In this way the tunnel can be instrumental in saving much time and expense by indicating whether a new device will be effective under full scale conditions or not, a point which could previously have been definitely settled only by a full scale flight test.

Tests for seaworthiness are now being carried out on model vessels in the William Froude Laboratory, which is attached to the National Physical Laboratory. The work of the Laboratory has already played its part in the production of the modern economical and seaworthy cargo ship.

In the work on the wind resistance of ships, which also affects the speed-keeping qualities of ships at sea, results are quoted in which the air resistance of a vessel can be reduced to seventy per cent of its present normal value. Work on the manœuvring capacity of ships has dealt with the form of rudder generally called "semi-balanced" and results are given for various shapes of such rudders, showing the effect of the twin screw races and the variation in manœuvring capacity produced by streamlining the rudder.

Measuring Temperatures.

Many industrial processes require not only a furnace in which high temperatures can be maintained, but one in which the precise degree of heating is under control. It therefore becomes essential to have some standard scale to which very high temperatures can be referred. Work on an international scale of temperature has been in progress at the National Physical Laboratory for a number of years and one of the points which serve to fix this scale at the higher temperatures is the melting point of platinum. Considerable attention has been devoted to the accurate determination of this temperature during 1932. It is interesting to note that whereas a book of tables published less than fifty years ago gave estimates of this melting point varying from 1,460 °C. to 2,534 °C.,

the investigation now proceeding is expected to result in a value reliable to about 2 °C.

The measurement and control of moisture in the air are rapidly growing in importance in many industries. Spinning and weaving sheds are no longer restricted to localities where the climate is suitable, since plant is procurable to control the humidity in any building. Timber seasoning is now usually conducted in special kilns instead of in the open air, while in the conveyance and transport of frozen meat, the humidity must be carefully controlled if the food is to arrive in the best condition. One of the most familiar instruments for measuring atmospheric humidity is the wet and dry bulb hygrometer, and the growth of interest in this subject is reflected in an investigation recently completed at the Laboratory, whereby tables have been provided enabling this instrument to be used between 40 °C. and 100 °C. (the boiling point of water). These tables have already been adopted in industry.

The same instrument is also being studied at lower temperatures. Below 0 °C. the wet bulb becomes coated with ice, but a more serious difficulty is that the difference between the wet bulb and dry bulb temperatures becomes extremely small, so that the instrument is not very accurate at low temperatures. An effort to remedy this defect is being made by the development of electrical methods for measuring directly the difference between the temperatures of the wet and dry bulbs.

X-ray investigations carried out on behalf of the Medical Research Council have shown that the dentine —the soft material in a tooth—is chemically similar to the enamel around it, the difference being one of structure and not of chemical composition. It is hoped by a study of the crystal structure of the enamel in decayed teeth, to discover exactly what are the processes which occur in the decay of teeth. The Laboratory undertakes on behalf of the National Radium Trust the testing of the national radium and its distribution to hospitals in accordance with the requirements of the Trust. The volume of test work arising from this duty is large, some 6,500 milligrammes (in value some £80,000) having passed through the Department during 1932.

The acoustics staff has for some years been studying the transmission of sound through panels of various materials, and attention has now been turned to panels consisting of two layers of solid material with an air space between them. In the case where the solid material is window glass, it appears from these investigations that the thickness of the air space is of some importance, and that the provision of a wider space may, at certain frequencies, actually increase the sound transmitted.

Exploring Northern Spitzbergen.

An Arctic expedition under the auspices of Oxford University Exploration Club has left England for Northern Spitzbergen. The motor-ship *Isbjorn* has been chartered for the voyage and will sail from Tromso. The leader is Mr. J. H. Martin, a member of Sir Douglas Mawson's *Discovery* Expedition of 1929-31, and the party numbers eighteen.

An announcement in the *Times* states that the area chosen for investigation is the New Friesland ice cap in the north of West Spitzbergen, where little exploration has been attempted. The only expeditions which have approached the south of New Friesland were those sent out from Oxford in 1921 and 1923, and that led by Mr. Jackson last year. It is therefore an attractive objective not only for pure exploration but as a testing ground for experiment in the technique and equipment of Polar investigation. The New Friesland ice cap has an area of approximately 2,000 square miles. As seen from the sea, the west coast of northern New Friesland rises steeply to about 4,000 feet, and an approach from the coast would be slow and difficult. On the east, however, the ascent from the coast to the inland ice appears to be more gradual, and it is expected that the Treurenberg Glacier will provide a comparatively easy route to the interior.

One sledge party, under the leadership of Mr. Fleming, geologist on last year's Cambridge Iceland Expedition, will have the topographical and geological survey of the interior and east of New Friesland as its objective. Another party will consist of two sledge units, each of three men. The first unit will attempt to carry out a photo-theodolite survey of the north and west, in addition to making geological investigations on the western coastal belt. The second unit proposes to cross the inland ice from the Treurenberg Glacier to an unnamed glacier halfway down the coast of Wijde Bay. This party is equipped with a seismograph, and echo-sounding observations will be carried out on the thickness and nature of the inland ice. Given satisfactory working of the instrument, results should have important bearings on glaciology. The success of the work planned by all three parties must greatly depend on the weather.

Correspondence.

SHOULD THE MODERN HOUSE BE A "WORK OF ART"?

To the Editor of DISCOVERY.

SIR,

Mr. Halliday's article in your July issue is delightful but highly provocative. His opening sentence suggests a conflict between a "work of art" and the "art of living." Those who consider that everything old is necessarily beautiful are mistaken, but if Mr. Halliday would have us think that the "sort of life lived to-day" is synonymous with the "art of living" he is on equally false ground. Indeed he seems to admit this later in the article when he refers to the modern "headlong rush of life," with its "difficulties in obtaining domestic help," its "increasing activities outside the home," and the "comparatively little time spent in the dining room" which "in some cases is accommodated in an alcove."

Perhaps it is this very departure from the principles that previously governed domestic life which prompts people to build houses suggestive of an earlier and less hectic age. Admittedly many replicas of ancient buildings are bad copies and ill adapted to their suburban surroundings; but to dismiss traditional designs on this account is unjustified. It is no mere accident that "a thing of beauty is a joy for ever," and although the half-timbered villa does so little justice to its Tudor ancestor, it is at least a tribute to the intrinsic merit of the earlier design.

The planning of the nineteenth century house is quite another matter. Everyone will agree with your contributor that its indifference to space and labour was often callous and inefficient, and has been largely responsible for the movement from domestic service to factory and office among women to-day. Whether it is better for girls to work in factories is another question, and the architect who would encourage the finer shades of living can hardly be guided by the assumption that every man must cook his own dinner, even with the aid of the many gadgets which the girls who should do the cooking are making instead, to the detriment of the culinary arts.

The modern house should, of course, be planned for smaller families and staffs than hitherto, and on this point Mr. Halliday's suggestions are of much value. But when he carries this to extremes and says that to have movable wardrobes, chests, desks and settees will in future be as "ridiculous . . . as it would be to transport our baths, kitchen sinks, and fireplaces to-day" he foreshadows a time when living will have ceased to be an art altogether and will be reduced to snatching a concentrated meal from the kitchen-cum-dining-cum-bridge table, in the intervals of turning from the cocktail cabinet to the setteebedstead! Desks will no doubt be as much a thing of the past as the books in the built-in shelves, which no one will have time to read in the scramble for stark "necessities" for which Mr. Halliday would have us design our houses.

If we follow tradition in designing furniture, why should a motor-car differ from a stage coach? Clearly, because the one is consciously planned to travel at 50 m.p.h. and the other at 8 m.p.h. On the other hand, the purpose of a bed (and the need for sleep) has not altered since the days of four-posters. Personally I enjoy motoring and flying whenever I have the opportunity. I am also interested in television. But since these pursuits are of secondary importance I take even more pleasure in having a desk or arm-chair of my own in which to work or rest—a steel one, if you insist!—which no communal fitted-in furniture could ever replace.

By all means, let us have modern designs, and the photograph on page 217 shows how pleasing these can be. But let us avoid the assumption that a design is necessarily "out of date" because it happens to have stood the test of time.

Yours faithfully,

Pembroke Square,
London, W.8. JOHN BENN.

AN INSTITUTE OF ORNITHOLOGY.

To the Editor of DISCOVERY.

SIR,

During the past few years developments in several branches of ornithology have become extraordinarily rapid. To mention only a few instances the attack on the migration problem through large-scale marking of wild birds, through experiments on the effect of light, temperature and other factors; the attack on distribution through intensive work on the territory theory, through bird censuses which sometimes involve more than a thousand observers, and through general ecological approaches; and the growing emphasis on the economic reactions of a bird population may illustrate the pace and scope of the advance. All these instances point to one evident conclusion—that the demands of contemporary research have in this field outstripped the training and organization available for meeting them.

At Oxford six years ago a series of researches were begun on the numbers, habits and economic status of certain Midland species, and these researches have recently depended to a large extent on government grants. Owing to the termination of these grants at the end of September the future of the work (papers on which have appeared or are pending in *British Birds*, the *Journal of Ecology*, the *Journal of Animal Ecology*, and the *Journal of Agriculture*) is imperilled. After consultations between representative field ornithologists it has been decided to try to turn the emergency into an opportunity by establishing a British Trust for Ornithology, to act as a permanent trustee and to raise through every possible channel funds to support an Institute of Ornithology at Oxford as a national centre. The Trust is seeking incorporation and has already been given or promised valuable assets in cash and in kind, including collections of MSS. whose permanent availability to research workers is of capital importance.

The Trust is appealing for £8,000 to carry it over the next five years, until permanent endowments can be arranged. Payment of donations may be spread over the whole period, and those who may be in a position to contribute or to help in any other way are urged to get in touch with the acting Hon. Treasurer, B. W. Tucker, University Museum, Oxford, or the acting Hon. Secretary, E. M. Nicholson, 58, Petty France, London, S.W.1, who will gladly give further information.

Yours, etc.,

H. BALFOUR.
C. S. ELTON.
GREY OF FALLODON,
(Chancellor of Oxford University).
H. ELIOT HOWARD.
JULIAN S. HUXLEY.
F. C. R. JOURDAIN.
PERCY R. LOWE.
SCONE,
(Chairman, British Trust for Ornithology).
H. F. WITHERBY,
(President, British Ornithologists' Union).

Testing Tyres: Some Modern Methods.

Modern standards of speed and comfort in travel have called for a highly developed technique in the testing of tyres. The following article describes some of the ingenious machines employed, and also deals with the exhaustive tests carried out on the road itself before a tyre is ready for service. A fine degree of reliability has been reached.

PNEUMATIC tyres have played an important part in the development of modern transport, and have long been adopted even for the heaviest vehicles. With the increasing call for speed, research workers have been obliged in recent years to seek improved materials and new methods of manufacture. The visible part of a pneumatic tyre is a few pounds of cotton and rubber; it is this surface which must resist wear, accept shock, and provide comfort over thousands of miles of road. Rigid tests are carried out before a tyre is put into service, commencing with the raw materials and continuing through every stage to the behaviour of the finished product in actual use.

The rotary track machine, showing the tyred wheel running in the concrete track in which stones are laid.

The Dunlop equipment for testing tyres is among the most up-to-date in the world. In the chemical laboratory a watch is kept on the purity and suitability of raw materials, which are subjected to exacting tests before being adopted, and research is carried out on new materials and on improvements in existing materials. In the test house there are many ingenious machines for inflicting "destructive effects" upon tyres. Any of the tests may be repeated many times without variation so that it is simple to compare the behaviour of one tyre with that of another. The atmosphere inside the building is maintained at a constant temperature day and night, and the disturbing effect of varying heat and cold is thus eliminated.

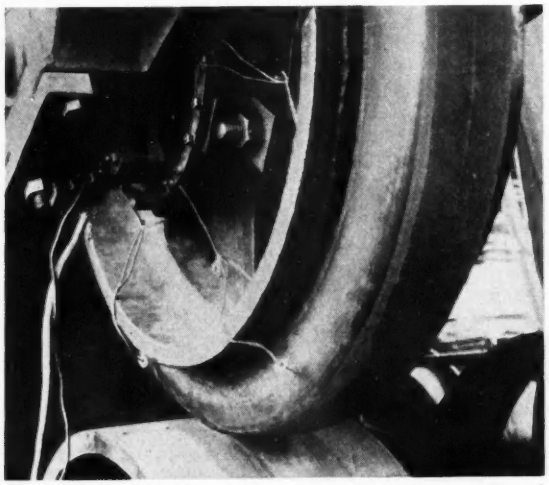
Among the apparatus in the test house is the rotary track machine. As the illustration shows, the tyre is mounted on the end of a double beam, and the wheel and tyre are sprung in conjunction with absorbers. The beam is weighted, and by means of an electric motor the complete mechanism revolves at a high speed, the tyre running in a circular concrete track in which stones are laid. At the side of the track is a kerbstone, against which the tyre presses on its journey round the track. This attempts to tear the sidewall rubber of the tyre away from the casing, and thus reproduces "rut wear" or kerbstone damage which is commonly encountered in actual service. By means of this machine such every-day problems as the heating of tyres, tread wear and ability to resist damage from stones may be closely examined.

Giant tyres present special problems for study. One of the machines employed in tests of this kind is the heavy rotary-drum machine. The tyre and wheel are mounted on a beam which presses the tyre against a drum. The heavy weights with which the beam is loaded are illustrated on the next page; these may be moved from end to end in order to vary the leverage upon the tyre. The drum is revolved at high speed, and in some tests obstacles are placed on the surface in order to subject the tyres to a series of blows. Two tyres, one above the other, may be tested simultaneously by means of a "duplex" rotary machine. The top tyre, heavily loaded with weights above, presses upon the lower, and a running belt between them provides a comparatively flat surface, preventing the patterned treads of the tyres from coming into contact. This is one of the most exacting tests for durability and may be varied in order to compare different types of tyres.

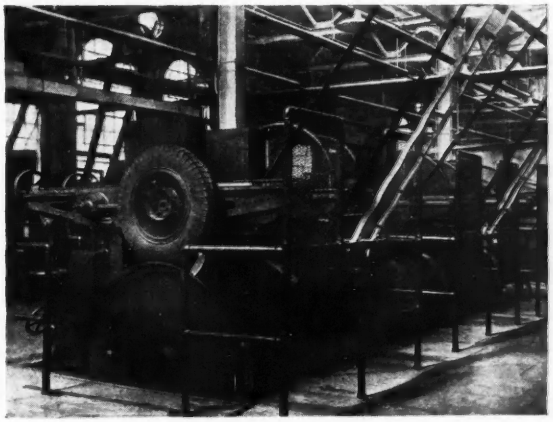
Under extreme conditions the fracture of a tyre is occasionally experienced in service and is referred to as a "concussion burst." This problem is studied by means of an ingenious device known as the impact test machine. A specially designed hammer is dropped on to the tyre, the height of the drop being varied according to the stress it is required to impose. An electric winding gear raises the hammer to the proper height, when it is automatically dropped. The force required to fracture the casing of a good tyre is

tremendous, as the massive nature of the testing machine suggests. An important study in connexion with the testing of tyres relates to the temperature developed at various points in the interior of the tyre when running under load. The mechanism employed in tests of this kind is illustrated in the photograph below. Special thermo-couples in the form of needles are driven into the tyre and give rise to minute electrical currents as the temperature increases. The measurement of the currents enables the temperature to be gauged with surprising accuracy.

While the indoor testing of tyres is of immense importance, tests on the road play an equally vital part. The Dunlop company maintains a "test fleet" of vehicles for this purpose whose performance in the normal conditions of service gives valuable information about the rate of wear in one tyre compared with that in another, the suitability of compounds, the effect of tread designs, and of size and contour of the tyre. For testing giant tyres there are the heavy lorries, built on the most modern type of bus chassis. Two of these have roof platforms which may be loaded in order to reproduce the weight of a double-deck bus, and thus test the tyres under accurate conditions. Then there are modern passenger cars capable of testing the relative merits of different tyres in their respective classes. The test fleet is completed by motor cycles and pedal bicycles, the latter covering fifty to seventy miles a day in all weathers. The distance covered during a year's tests is over 2,500,000 miles, or more than a hundred times round the world. Over a distance of 390,000 miles, only six hold-ups due to tyres were recorded on the road, or one hold-up in 65,000 miles. Taking the normal yearly mileage of the average motorist, this is equivalent to one stop in seven years! The modern tyre has more than kept pace with the increasing call for speed and with the changes in vehicle design.



Thermo-couple needles which create electrical currents and enable the temperature of the tyre to be measured.



The rotary drum machine in which the wheel is mounted on a beam that presses the giant tyre against the drum.

The usefulness of high speed racing is sometimes questioned. But as Sir George Beharrel and other experts point out, racing provides the research worker with information which could not be obtained in other ways. In the manufacture of tyres, as on the Turf, "racing improves the breed." Safety, comfort and speed are accepted to-day as a matter of course, and in this the pneumatic tyre has become a vital factor. Its reliability is reflected in some recent statistics. The tyres of one omnibus fleet, for instance, have been found to cause road stops once in 400,000 miles, a fine degree of reliability.

Agriculture has provided a new field for pneumatic tyres. Their introduction for horse-drawn vehicles both on the road and in the field is comparatively recent. Tests have proved that this innovation presents many advantages, for ground impassable to iron-clad wheels is easily traversed by pneumatic tyres, and loads at least fifty per cent greater can be carried without additional effort. The advantages of the pneumatic tyre are increasingly being recognized by farmers, and its use even for wheel barrows and trolleys where fragile loads are to be carried has come into growing use. It is almost unnecessary to mention the importance to aircraft of reliable tyres; they have assumed immense proportions as the size of machines has increased. Thus the testing of tyres embraces every class, from those of the giant air liner to those of the gardener's wheelbarrow.

Book Reviews.

My Philosophy. By SIR OLIVER LODGE. (Benn. 21*s*.).

Reviewed by PROFESSOR D. F. FRASER-HARRIS.

In this work Sir Oliver Lodge has given us a powerful but eminently readable exposition of his carefully considered views regarding the consitution of the Universe—past, present and to come. No evidences of senility are to be detected in this penetratingly thoughtful and majestically comprehensive study of the inter-relations of matter, energy, radiation, life, mind and the *aether* of space. For it is a pity that when the chemists gave a name to the homologous series of the oxides of the alcohol radicles they used with altered spelling the venerable term (a)ether. Nothing is too vast and nothing too minute for Sir Oliver's acute mind to analyse, and that mind seems as fresh and vigorous to-day as it was sixty years ago when atoms were still only conceptions, oxygen and the atmosphere " permanent " gases, radio-activity and X-rays unknown, and Albert Einstein's cradle not to be seen till six years later.

This work is true " philosophy " if by that is meant a consistent and courageous attempt to get behind appearances and sensory data in order to enquire into the underlying permanent realities. Every fundamental principle known to science since the time of Galileo is examined and assigned its relationship to modern speculation. For Sir Oliver's historical references are not the least helpful things in this volume. As might be expected, the property of inertia of matter receives detailed treatment, and the Newtonian conception of gravitation is related to the most recent speculations of Sir James Jeans. Sir Oliver's candour is exemplified on page 116 where in one particular he confesses he is unable to follow Jeans's argument.

The author stoutly refuses to be led into any region of mental fog where mathematical abstractions (not conceptions) expressed in formulae are assumed to represent cosmic realities. Lodge rightly objects to some concepts regarding the constitution of the Universe being " swept away " because they are found to be incompatible with certain " postulates " (not experiments) of mathematical theorists. Indeed a refreshing sanity, a breadth of vision, a sympathetic tolerance for opposite views and a sagacious absence of omniscience characterize the penetrating discussions in this work.

As might be expected, the aether of space is regarded as a reality and as something whose existence must be postulated in spite of modern " gibes " thereat with which a whole chapter (XII) is concerned. In fact, Chapters XII and XIII are vigorous and youthfully minded replies to those who are within a little of denying the existence of the obvious on the strength of a formula. Chapter VII is a convenient summary of what the venerable author regards as " new knowledge " about the Universe.

The biologically minded reader will find much that is valuable and, as is usual with Sir Oliver's thinking, fundamental about life, its nature and its relations to matter. In the first place it is denied absolutely in opposition to Sir Arthur Keith that life is a form of energy. For Sir Oliver has very decided views about what is and what is not energy ; electricity, for instance, is not now regarded as a form of energy contrary to what we had been taught last century. Life Lodge holds to be a directing and controlling influence, one that guides without interfering with the conservation of energy in the living body. The view that life, mind and consciousness are allied realities capable of separate existence and are not functions of (animated) matter is naturally developed in some detail as it has for a long time been one of Sir Oliver's settled convictions.

Thence we are led to consider themes more popularly associated with the name of this great modern thinker—survival of bodily death and the objective reality of the realm of spirit. The chapters devoted to these themes are singularly candid, open-minded and temperate. Convinced as the author is of the fact of human survival of bodily death and of the occurrence from time to time of phenomena at present called " para-normal," he frankly admits that no amount of outside testimony will convince some of his scientific colleagues. In the " Nature " that is contemplated by the Royal Society there is nothing " para-normal." All he asks for is an open mind on the part of orthodox scientists and not any *a priori* condemning of something as absurd and impossible because it is unusual, extraordinary or " incredible." In this connexion the candour and elasticity of Sir Oliver's own mind is amazing when we consider that he was already twenty-three years old when Tyndall gave his famous address to the British Association at Belfast, that veritable confession of faith of the Victorian materialists.

Lodge had from Sir William Crookes' own lips accounts of phenomena so amazing and contrary to experience that he can quite understand their not being credited even to-day. For even some first-class minds will not accept a very extraordinary fact unless at the same time they have a plausible explanation all ready for it. Sir Oliver Lodge's sheer intellectual honesty has got him into trouble with some less courageous scientific thinkers. In some ill-informed quarters this great English savant is thought of as a credulous old ghost-hunter largely because he has had the courage and honesty to declare in very plain language that he has had *evidence* forcing him to personal conviction of what, after all, every Christian is supposed to believe, that man is immortal, and that, " dust thou art, to dust returnest was *not* spoken of the soul."

Indian Air. By PAUL MORAND. Translated by DESMOND FLOWER. (Cassell. 6*s*.).

As an essay on South America in 235 pages this book is necessarily slight ; but as a brilliant account of modern air travel it could not be bettered. The author explains that the stories of the air hitherto given to the public deal with " great deeds, nocturnal perils, audacious records, unheard-of prowess." By contrast he wishes to describe the ordinary round of the traveller who " waves to the bi-weekly aerobus to stop . . . climbs into the cabin in the morning, lunches there, reads there, drowses there, and gets out again in the evening to go to rest." Nothing, however, could be less ordinary than the adventures that follow.

The book pays a tribute that is long overdue to the pilots of several nationalities who are pioneering in the establishment of air transport throughout South America. While Britain has been blazing the air trail to India and the East, it has been left to the United States and France to develop the air routes of the southern continent, which now has the most extensive and regular services in the world. M. Morand is critical of the French authorities for allowing the Aéropost to operate with inadequate machines on their arduous flights over mountain and sea. He contrasts the all-metal aeroplanes and safety factors characteristic of the Americans, although this does not diminish his admiration for the achievements of his own countrymen under much greater difficulty.

An opening chapter deals with the significance of the air in

American history. "All the civilizations of America have worshipped the Sun and adored that which soars towards the Sun: the bird, the aeroplane. In South America, though there are as yet no more than a dozen air lines, there are, on the contrary, 2,500 species of bird, each with its favourite altitude, climate, flower and grain; the Egg dominates religion and life as it surmounted, as a symbol of fecundity, the Inca throne. Earlier still, as the basis of pre-Inca mythology, the bird protector is already there. . . . Humboldt says that a dove taught articulate speech to the tribes of the Andes."

Carrying his analysis further, the author observes that America is the land of the straight line. Until the arrival of the European colonizers, the wheel and the tower were unknown, and American art has always ignored cyclical movements. Clearly this continent, above all others, was made for the aeroplane.

The present flight begins at Buenos Aires, and there the description pays too much attention to its night clubs and the tango, which so many writers have discussed *ad nauseam*. But M. Morand is soon in his element again at the Santiago aerodrome, waiting to set off to Chile and the north. Before leaving he puts through a telephone call to his home in Paris, and the marvel of this appeals to his imagination as much as flying. In a padded booth "a pair of earphones suspended from the ceiling fitted my head. I was in the fourth dimension, suspended in some extra terrestrial void; I could hear myself breathing. . . . The whole world was assisting me in my task; every relay was at its post: Buenos Aires, Rio, and, far away among the sharks, the island of San Fernando. There at last was my own country. . . . I strained my ears attempting the impossible; over the Andes, over the pampas, across the equator, under the depths of the Atlantic, beneath the anchors, the sea wreck and the many coloured fish, the sound went out to ancient Europe. A miracle . . . on the shores of the Pacific I heard suddenly from the Champs de Mars, the mew of my cat."

In the telephone booth it was noon, but in Paris the lamplighters were already going on their rounds. Only when the author remembered this did he begin to feel those emotions which he should have felt while those distant voices were echoing from the depths of the Old World. Yet once the aerobus has left the ground to soar over the mountains to the north of Santiago, the glamour of the New World reasserts itself and beneath a sky of perfect blue the machine is suddenly on a level with the towering buttresses and icy needles of the Andes. "I was never borne through the air by so fine a bird." Although there was "nothing but an infinite void and the abrupt landscape underneath, we had not placed ourselves at the mercy of the air; it was the air, conquered, that obeyed us."

To quote further would not be fair to the reader, who must experience for himself this enthralling flight from Chile to Peru, thence to Panama and across the Gulf of Mexico to New Orleans. M. Morand has the gift of seeing everything in all its freshness, but then, to use his own words, "one of the most charming things about aviation is that everyone to do with it is so young."

Thou Shalt Not Catch Cold. With a Foreword by ALEXANDER FRANCIS, M.B., B.Ch. ("Daily Express." 1s.).

The anonymous author of this booklet describes a simple system of exercises by which he has enjoyed more than three years' immunity from colds. After serving in India during the war he found the rigours of the English climate so trying that he was unfit for commercial life. In self-defence he studied the problem thoroughly, and came to the conclusion that while many excellent remedies can be used, "the whole system of waiting until a cold has been caught is treating colds at the wrong end." The outcome of the author's researches is best described in his own words. "I can now go about my duties in all kinds of weather perfectly sound and perfectly fit. I am never inconvenienced by sudden changes in temperature, and during the last of the three years I have not found it necessary to differentiate in underwear for summer and winter."

The importance of the circulation to health is well known, and the exercises are designed to encourage the flow of blood throughout the whole surface of the body, so that the skin may function properly in its reaction to changes of temperature and other conditions. In particular, the channels in various parts of the head are stimulated, so that the sinuses may not become choked with mucus, as is their tendency when the blood is not kept flowing freely. To describe the system in detail is obviously impossible here, but lest the prospect of twenty exercises should defer any reader from attempting them, it may be mentioned that most of them are performed with the finger tips, and the whole series requires only four minutes to complete, an illustrated chart being provided.

There is nothing "quackish" about this book. The dangers of letting a cold "run its course," while the sufferer not only takes risks himself but thoughtlessly infects other people, are wisely stressed, and general precautions are suggested for the treatment of colds. It is pointed out that chills and "stiff neck," normally contracted from sitting in a draught, may be averted by rubbing the affected part to restore the circulation.

The reviewer cannot claim to have tested the system over a long period but has used it with advantage during an attack of hay fever this summer, obtaining temporary relief from congestion by rubbing the face, neck and head in the manner advised. Curiously enough, neither hay fever nor asthma are mentioned by the author, but the importance of circulation in both complaints is now receiving attention, and it is significant that the foreword to the book is written by a well-known specialist in this field of medicine.

The Beauty of England. By THOMAS BURKE.

Scotland's Rainbow West. By J. J. BELL.

The Charm of Brittany. By R. A. J. WALLING. (Harrap. 7s. 6d. each).

Travellers of every taste will welcome these additions to an admirably produced series. In spite of a literary style which in parts suggests the "guide book," Mr. Burke is entertaining, and he knows his business. Omissions can always be found in a book of this kind, but on the whole the author has made a judicious choice. He pays deserved attention to parts of the countryside which have largely been neglected—and are better for their neglect. We are glad to find a chapter devoted to Essex, "the Cinderella of our counties." Although, as Mr. Burke observes, much of its interior and the greater part of its coast are graceless and bleak, Essex has its beauty spots, still unspoiled by "modern improvements." The author notes the lack of poetry in the names of many Essex villages: "Which of us would accept a fine old manor and all its rights if we had to head our notepaper from, say, Ugley, or Messing, or Maggot's End, or Mucking, or Cabbage End, or Rotten End?" But what could more impress our friends than a letter headed from Tolleshund D'Arcy, or Theydon Bois, or Havering-atte-Bower, or Saffron Walden, or High Beach, names as picturesque as you'll find?

No one is better qualified than Mr. J. J. Bell to write of the

west of Scotland. There is nothing of the guide book here; but bearing the purpose of the book in mind, Mr. Bell has divided it into parts, each being complete in itself in that it provides sufficient interest for a short holiday. Bases or centres are indicated, and excursions are sketched, not only because they are worth making but because they allow of a continuity of description which best displays in a general way the attractions of the west coast and its surroundings.

Guide books to Brittany are plentiful, and we are glad that Mr. Walling makes no attempt to add another. What he does is to provide the traveller unfamiliar with the history and racial characteristics of Brittany with a background against which to set his own observations: "To the real seeker, Brittany will yield up its unique secret, that it is the very country Great Britain might have been but for the Anglo-Saxon invasions." Leaving the historical side, Mr. Walling takes a general survey of Brittany to-day, tracing a course along the coast from the confines of Normandy to the mouth of the Loire, and later exploring the less known interior. Landscape, architecture, customs and historical incidents are described on the way.

Film. By RUDOLF ARNHEIM. Translated from the German by IAN MORROW and L. M. SIEVEKING. (Faber & Faber. 15*s*.).

The past two or three years have seen the publication of a number of books in which the power of the film as a medium of creative expression, propaganda and education has been analysed, from different points of view and with different conclusions. Since, as Mr. Paul Rotha says in a foreword, there has never been a time when a good film was so assured of public support as it is to-day, it is a matter for regret that no more than one film in a hundred can claim to possess any artistic, educational or even entertainment value. Herr Arnheim is to be congratulated on his farsighted analysis of the possibilities and problems of the cinema.

Innovations, especially in the cinema, are too often accepted necessarily as improvements. It is not always the case. Though the entertainment value of the film was no doubt improved by the addition of sound, much of the individuality of the cinema's appeal was thereby lost. The latest experiments are concerned with natural colour and three dimensions. "What will happen," the author asks, "when colour-film processes have been sufficiently improved? Shall we ever be able to achieve as pregnant a creative method, as great as independence of 'reality' when colour is present? The masterpieces of painting prove that in graphic art colour provides wider possibilities than black and white only, and at the same time permits of a very exact and strict style. But can painting and colour photography be compared?" The author points out that while the painter has a perfectly free hand with colour and form, photography is obliged to record mechanically the light values of physical reality. There remains only the possibility of controlling the colouring by clever choice of what is to be photographed.

Economic Mammalogy. By JUNIUS HENDERSON and ELBERTA L. CRAIG. (Bailliere, Tindall & Cox. 26*s*.).

The authors, who are American scientists, have collected and condensed much useful information concerning the economic relations of mammals; their bearing upon the welfare of the human race; their food habits; and the methods of preserving the more useful species and of controlling the more harmful. As they point out, economic mammalogy centres about four main questions: What species are useful or harmless and entitled to reasonable protection? How may they best be encouraged and protected? What species are more harmful than useful and should thus be kept in check? How may they best be controlled or destroyed or the danger they cause be minimized? These are simple questions, but their solution is hindered by many difficulties. It is a common experience that a species that is not conspicuously injurious or is even definitely useful in ordinary circumstances may, in other circumstances, temporarily become injurious. The authors mention the meadow mice which in most localities are not sufficiently abundant to do a great deal of damage; when, during favourable seasons, however, their numbers are enormously augmented by a low mortality rate and high fecundity, they quickly become a menace. Many other examples might be mentioned; and there is also another side to the problem: "In an unsettled region, infested by an overabundance of rabbits, prairie dogs and ground squirrels, a few coyotes to keep these rodents in check may be useful, but with the advent of stock and poultry raising, a marked increase in the coyote population would make them quite harmful in the destruction of poultry, lambs and calves, or entail much expense in the effort to prevent depredations."

Economic mammalogy's first problem is obviously to place in the balance the beneficial and injurious habits of each species, and thus to ascertain whether it is more or less harmful than useful. Many branches of modern industry are intimately connected with mammals and mammalian products. The authors first consider some of the "aesthetic relations" of mammals, and late discuss the practical side of their subject; they show the immeasurable value to the human race of certain mammals which provide us with food, clothing and other products, and those which in the past have furnished the chief means of transport. On the other hand they stress the injury caused by other species—in the destruction of crops, foodstuffs and property, and by interference in various ways with industrial operations. In the second part of the book the economic relations of the various groups of mammals are considered in systematic order. The book seems to be mildly expensive, but it is a painstaking analysis of an important subject.

Christina of Sweden. By Margaret Goldsmith. (Barker. 10*s*.).

Christina of Sweden, daughter of Gustavus Adolphus, has remained something of a puzzle to historians. In spite of her unusual talents and her inherited opportunities, she accomplished little. Why did she give away her throne, and why, turning her back on Protestant Sweden, did she become a Roman Catholic? Miss Goldsmith shows how the Dowager Queen, Christina's mother, constantly reminded her daughter of the disadvantage of being a girl, yet reproached her with equal persistence for her markedly masculine ways. It is small wonder that the Queen's tactless insistence on more feminine behaviour produced opposite results in her daughter. As the author suggests, with a little psychological insight, the Dowager Marie Eleonore might have employed other methods to achieve her ends, and Christina, as she matured, might have realized that to some extent at least, her exaggerated masculinity was due to her mother's influence.

Miss Goldsmith not only draws a clever portrait of Christina from the point of view of the modern psychologist, but her book also provides an interesting sketch of the state of Europe in the seventeenth century.

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